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Cassirer and Structuralism of Perception:

An Application of Group Theory to Gestalt Psychology

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BY

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17 OCT 2007

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**Department of Philosophy
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Abstract

Ernst Cassirer's task was to set up an account of perception as objective judgement. We can trace Cassirer's view of perception through three different accounts each of which aimed to give an answer of how perceptual judgements can be possible. These three accounts started from (1900-1923) where he presented his view depending on Functional- Relational analysis of perceptual experience. The second account started from (1923-1933) where he presented his view of perception depending on symbolic analysis of perceptual experience, and finally the third account started from (1933-1945) where the analysis of perceptual phenomena has been made depending on his apprehension of Group Theory.

The main target of Cassirer in the third account was to show that there is similarity between geometry and perception with respect to the ways both of these two disciplines build up their objects. Having the same logical base, Cassirer claimed that there is similarity between geometrical determination of the object and perceptual determination of the experienced object. For Cassirer, this similarity is what allows an application of "group theory" to perception. As a result of that claim, Cassirer shifted mathematical terms such as "invariance", "frame of reference" and "transformation" from the province of geometry and re-used them in the field of perception for setting up what he called psychology of thought.

This thesis discusses Cassirer's first two accounts and focuses on the third account by giving examples of how the mathematical concept of "group" can be used as an analogy to provide an intrinsic explanation of the nature of the objects and their characteristics one experiences during the perceptual situation. The explanations of the perceptual phenomena represented in the perceptual experience, as given by Cassirer, based on Gestalt psychology, reflected this

understanding. The ample examples created by the Gestalt psychologists and used by Cassirer indicated how both understood the object of perceptual experience as constructed and not as *a thing* or *hic et nunc*.

I will show that in these three accounts, there are non-physical elements, which defined here as structural elements, involved in the perceptual experience. By the virtue of these non-physical elements, perceptual judgements are possible. Cassirer and the Gestalt psychologists emphasized that these structural elements are presupposed in every perceptual experience and this understanding will lead to the claim that both Cassirer and the Gestaltists presupposed the constructive unity of mind based on a transcendental analysis of the nature of mind and its cognitive processes.

Dedication

This is dedicated to the loving memory of my parents, may Allah bless their souls, whom I wished to share me this special moment in my life.

Acknowledgment

My great thanks and gratitude are to the person who has been patiently offering his valuable advice, encouragement and suggestions in order to make this work possible. Dr Robin Hendry who, with an indefatigable zeal, helped me to prepare this thesis and has been at all times dealing with me as a friend rather than a supervisor. I am indebted to him all my life. I also wish to express my deep gratitude to Professor Barry Gower and Professor J. Lowe for their help and suggestions that guided me all the way through. I would also like to thank Professor Steven French who gave me guideline on the whole project. He was the first to whom I spoke about the first plan. Without his keen interest in the subject matter, I could have hardly found the courage to start.

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Declaration

The material contained in this thesis is the work of the author alone and no part of it has previously been submitted for a degree at any university.

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The Epistemological and the Metaphysical Developments of Perception:

A Historical Review of some Philosophical Accounts of Perception

1.1 Introduction

Perception is one of the most important concepts in philosophy of mind. Therefore, it is necessary to discuss this concept from a historical point of view, to show its development and to illustrate the epistemological and metaphysical issues it raises. To study perception one needs to answer how it is possible for perception to provide us with knowledge about the external world. That is why it is fruitless to discuss perception without discussing the general frameworks within which philosophers have just their epistemological and metaphysical accounts of perception that philosophers have given. My aim in this chapter is to introduce the different views of perception provided by major philosophers and to critically discuss and analyze the epistemological and metaphysical claims upon which they based their theses.

We also need to address whether the questions philosophers ask about perception are entirely different from those raised by psychologists. Although philosophers have discussed perception from different perspectives, the most common fault has been the failure to differentiate between their epistemological doctrines and psychology as an independent field of empirical study. Aristotle, for example, presented his epistemological doctrines and gave them a psychological dress without making clear the differences between epistemology, which is concerned with the nature and possibility of knowledge, and psychology which is concerned with the mechanism of perception.

The question that needs to be addressed is how we can define perception. This is a difficult question as there is no absolute and final definition of perception. This can be easily seen by looking at different analyses of perception. The difficulty here, it seems to me, does not concern the concept of perception in itself. Rather, it emerges from the variety of epistemological and metaphysical concerns and backgrounds of philosophers. Although there are different definitions of perception, there is a comprehensive and



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general view of perception is presented by R.J. Hirst. He presents perception as the awareness of the objects of external world, in order to distinguish it from imagination and illusion:

Perception is the awareness of the external world - of material objects, to use a technical term for physical objects in general, animals, plants and human beings insofar as they are perceptible (their bodies, in fact). The main characteristics of such objects are that they are external, independent of the percipient, and public, meaning that many people can perceive them at once. Perception, in being the awareness of such objects, may be contrasted with imagery, bodily sensation, or having dreams.

(Hirst, 1967: 79).

That account of perception seems to approach realism, by confirming the independence of the external objects from the perceiver himself. However, my general theme throughout my arguments in the next chapters is that a philosophical understanding of perception should not be based on realism but on constructivism. The central claim of constructivism is that the external object is not given to the perceiver in a simple way. Rather, it must be constructed. Therefore in order to distinguish my understanding from the realistic account of perception, it is necessary to present a new definition of perception that will be reflected throughout the coming next chapter. I understand perception as the ability to organize the relations between the elements of perception and group them in a constructed frame or pattern. The importance of this definition is that it shows the tremendous ability of the mind to create new orders and to arrange the relations of the perceptual elements differently in a way that allows the perceiver to perceive various representations of the same object. For example, an object can acquire new perceptual characteristics even though the new characteristics are not part of the perceptual elements forming the object. This shows that the objects we perceive are not an outcome of simple aggregation of perceptual elements. Rather, it presupposes a structure within which different perceptual form is given to perceivers. We can perceive that an object moves if we display photos of it very quickly at interval is of less 0.5 seconds. We cease to perceive the same object as moving if the time between each photo is more than two seconds. Therefore, the object as we perceive it seems to move even though motion is not a characteristic implied by relations between perceptual elements. To perceive a different object out of the same perceptual elements depends primarily on the structure or the order that we create, not on the elements themselves. Therefore it

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seems to me, as I will argue throughout my thesis, that perception is determined by the various ways of re-arranging the elements of perception and fitting them into a convenient structure. Therefore I claim that it is a mistake to consider that the nature of the objects we perceive depends on the perceptual elements themselves considered unchangeable and fixed and not re-orderable in different ways.

In this chapter, we shall examine some famous epistemological views of perception. In addition, I will try to reveal the logical structure of perception: whether it is the awareness of a mere collection of sensations or whether perception transcends that logical ground and can be considered as a constructed principle that organizes the relations among particulars.

1.2 Aristotle's Concept of Perception

Although Aristotle's account of perception was not adequate to reveal the complicated issues included within perception, he did give a definition of perception and presented criticisms to distinguish his own view from that of his predecessors. My goal is to discuss Aristotle's view of perception and to show how successfully he managed to cover its aspects. Moreover I aim to realize the relationship between his epistemology and his theory of perception and whether there is a relationship between his metaphysics and his view of perception. If the answer is yes, then the next question should be how significantly his metaphysics is reflected in his analysis of perception. Finally we try to find a connection between his *De Anima* and *De Sensus* where they considered two bases for his theory of perception.

To capture Aristotle's view on perception, I argue that metaphysics and physics are the two main grounds on which he based his view of perception. Aristotle has a realist view of perception. This can be shown by his definition and analyses of the nature of perception. To give a definition of perception, he depends on his primary distinction between matter and form. This distinction can be shown in the three definitions that he gave of perception. Perception takes place when the perceiver becomes like the object (on the soul 417A18) when the perceiver acquires the form, but not the matter of the object (424A18-24) and finally when the perceiver that was potential becomes actual (418A3) (Irwin 1998, 425)

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In fact, all the above-mentioned definitions of perception imply a certain type of alteration. In other words, perception occurs by the perceiver being changed and acted upon by the sense organs. Aristotle's main interest in *De Anima* was to clarify all the different ways in which something can be affected and altered. As evidence of that, Aristotle gives more references to the notion of alteration when he discussed perception. He explains what kind of change is involved in perception. The first kind of alteration or change is that of becoming like, or similar to the object of perception. Aristotle states in his *De Anima* that:

As we have said, what has the capacity for perception is potentially such as the object of perception is already in actuality. For when it is affected it is not similar, but once it has been affected, it is assimilated to it and such as it is. (Aristotle, 418A3-6).

To have the capacity to perceive something, the sense organ must be capable of being affected by an object of perception in such a way that it becomes like that object.

The second kind of alteration is when the sense organs take on the perceptible form of its sensible object. It was the perceptible form and the matter that Aristotle was concerned with when he discusses how perception works. Aristotle again reports in his *De Anima* as follows:

In general, with regard to all perception, we must take it that the sense is that which can receive perceptible forms without their matter, as wax receives the imprint of the ring without the iron or gold, and takes the imprint which is of gold or bronze, but not qua gold or bronze. (Aristotle, 424A17-21).

According to Aristotle, the sense is receptive of the perceptible forms without the matter, and to receive the perceptible forms, it needs to have the capacity that allows it to perform its function as we shall explain when we discuss how the sense organs receive the external object. These are the two meanings of alteration implied in Aristotle's definition of perception. There is another meaning that is implied in the second meaning that we discussed above. This meaning is the potentiality and actuality. For a sense organ has the potential to receive until the external object activates it. According to Aristotle, there are two levels of actuality for any sense. The first actuality is when the sense possesses the capacity to receive; the second actuality is achieved when the capacity is activated and something is actually received. (Aristotle, DAII.I, 412B20-2).

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For example, what makes an eye an eye, is that it possesses the capacity for sight. This is the first actuality of an eye. The second actuality is achieved when the capacity is activated and the eye actually sees. Therefore when the eye loses its capacity of sight it ceases to exist. When the eye achieves its second actuality it becomes similar to the object of perception. In other words, when the external object acts on a sense organ generally, then it will produce an alteration in the eye which will be assimilated to the object and become like the object. Here we can see that the three senses of perception show the fact that perception implies an alteration. However, the next question is what is the nature of that alteration?

Before answering that question, the different ways in which something can be affected and altered need to be explained. Aristotle understood the object of perception in only three possible ways. By the object of perception, either a proper object of one sense organ or a common object which are perceived by virtue of different sense organs from one side, or he means by object of perception an object that is perceived accidentally from the other side. If an object stimulates a certain sense and only that sense, then Aristotle calls it a proper object. For example, Colour is a proper object for the sight and tone is the proper object of hearing.

In dealing with each of the senses we shall have first to speak of the objects which are perceptible by each. The term 'object of perception' is spoken of in three ways, of which two we say are perceived in virtue of themselves and one is perceived accidentally. Of the first two, one is proper to a single sense and the other is common to all the senses. I call a 'proper object' [sc. of a sense] that which cannot be perceived by any other sense and in respect of which no error is possible; in this sense colour is the special object of sight, sound of hearing, flavour of taste.... Such objects are what we call the proper objects of this or that sense. (Aristotle, *De Anima* 418A7-17).

In addition, Aristotle indicates that there are objects that can be perceived by any sense and of these, some are actually common to the senses such as motion, number and rest. Such sensibles are not proper to any sense, but rather are common to all. Finally Aristotle indicates a third type of object of perception which he calls an accidental object of perception. The accidental object of perception is not strictly shown by perception itself, but is something we take to be associated with it on the basis of earlier experiences. Aristotle calls it "perceptible by association" *aistheton kata symbebekos* (See Brentano 1978, 26). Aristotle explains the accidental object with the example of the son of Diates. He explains that if the white thing was the son of Diates, then one perceives it

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accidentally because it is an accident of the white thing one perceives. In other words, the son of Diareos is seen, not because he is the son of Diareos, he is seen because he is also a white object and in virtue of this, is able to act on the eye.

Common sensibles are movement, rest, number, figure, magnitude; these are not proper to any one sense, but are common to all. There are at any rate certain kinds of movement which are perceptible both by touch and sight. Something is said to be an accidental object of perception, e.g. if the white thing were the son of Diareos. One perceives this accidentally because it is an accident of the white thing which one perceives-hence one is not affected by the object of perception as such.

(Aristotle, *De Anima*, 418A17-25).

Among these three types of perceptible objects, Aristotle gives much attention to the proper objects of perception as they seemed to him more reliable than the other two objects of perception. These are the objects of perception that bring about alteration to the senses. Now I answer the earlier question: what is the nature of that alteration that is caused by perceptible objects on sense organs? It is a physical alteration caused by external objects and takes place in the senses. For Aristotle to explain that physical alteration, he needed to clarify how it is possible for the perceptible objects to stimulate and act upon our senses. He assumes a medium between the external object and the sense organs. The nature of the medium is matched with the physical nature of the sense organ. For example, the organ of sight must be able to take on the colours of its objects and this means that it must be made of something transparent such as water. The reason the medium must be transparent in the case of sight is that colour produces an effect in the eyes and this would not be possible if the medium was not transparent. In other words, the medium needs to be transparent because it is receptive of colour. Aristotle states:

It is true that the eye is composed of water, yet seeing occurs not because it is water but because it is transparent-something common to both water and air. But water is more easily confined and condensed than air and this is why the pupil, i.e., the eye proper, consists of water.

(Aristotle, *Sense2*, 438A12-16). This physical alteration occurs also in the other senses, sound, taste and smell.

The material explanation of Aristotle's account of perception finds great support among those scholars who are generally interested in Aristotle's epistemology. For instance, Everson discusses Aristotle's theory of perception in the light of material interpretation and Modrak, in his 1987 *Aristotle the Power of Perception* supports the material

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explanation of Aristotle's theory of perception as opposed to the 'spiritualist' account claimed by Myles Burnyeat. On the spiritualist interpretation, the change brought about by the proper object of a sense can be understood as a cognitive change, or a change which can only be undergone by a sense. In other words to the spiritualist, in contrast to the materialist, the perceptible form cannot be described other than as the capacity for being perceived, and the change in the organ only explains the perception in virtue of its instantiating that form (See Everson, 1997: 57-60, also Everson, 1995: 179-183).

In his reading of *De Anima* II.5, Burnyeat argues that the physical material of which Aristotelian sense organs are made, does not need to undergo any ordinary physical change to become aware of a smell or colour. However, he claims that the physical material of animal bodies in Aristotle's world is already pregnant with consciousness needing only to be awakened to the sensation of red or warmth. (See Burnyeat, 1992: 19-20).

Aristotle in his view stressed the material alteration as an alternative way to express his view of perception. Aristotle did not have any problem applying his view of soul or *psuche* to his view of perception. In addition he used his explanation of soul to bring more clarification to his theory of perception. This can be seen in his definitions of the soul and in his discussion of its capacities in respect of the sense organs. In *De Anima* II, Aristotle provides three characterizations of the soul. It is described at 412A16 as "the soul is a substance qua a form of a natural body"; at (412A27-28) as "the first actuality of a natural body which has life potentially" and finally at 412B5-6 as "the first actuality of a body which has organs". The same thought here is also applicable to the soul. There are two levels of actuality. When the organ possesses the capacity this is what Aristotle calls the first actuality, and when the capacity is practiced or exercised, this is the second actuality. If the soul is considered to be the form of all natural bodies and if any sense organ ceased to perform its function because there is no life in that sense organ, then perception is no longer possible because a natural body cannot perceive either, because it is no longer alive. No dead sense organ can perform its function because it has lost its capacity to perceive.

This understanding can be revealed in his third characterization of the soul when he describes it as a first actuality of a body that has organs. It seems to me that it is the soul

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that is considered the first cause presupposed before we even ask whether or not sense organs have the capacity to perceive their proper objects. The soul activates the sense organs because the sense organ cannot have the capacity to perceive if the natural body is dead. Even though the soul as a cause of perception is not perceived, we can deduce its existence from the physical effect on the sense organs activated by it. It is the soul that justifies the changes that take place in all living bodies. Therefore, Aristotle considers soul not only as the cause of a living body but also as the principle of the changes that occur in the living body.

The *psuche* is also the primary source of change of position but this capacity is not found in all living things. But alteration and growth are also due to the *Psuche*. For perception seems to be a kind of alteration and nothing perceives which does not share in *psuche*. (Aristotle, *De Anima*: II.4, 415B21-26).

According to Aristotle, the soul is the cause of perception in the sense that it brings about the changes to living bodies because it is considered the first actuality of the physical body. Even if we accept this view, we need not to deny that Aristotle gave much attention to the external objects that activate our sense organs. Now let us discuss the importance of perception and the role it plays within Aristotle's epistemology

1.2.1 Perception and Aristotle's Epistemology

In his metaphysics, Aristotle shows the importance of the senses as a source of knowledge. He refers to this idea in his metaphysics by claiming that:

All men by nature desire to know. An indication of this is the delight we take in our senses; for even apart from their usefulness they are loved for themselves; and above all others the sense of sight. For not only with a view to action, but even when we are not going to do anything, we prefer sight to almost every thing else. The reason is that this, most of all the senses, makes us know and brings to light many differences between things. (Robinson, 1986: 80 From Aristotle's metaphysics A 980A 21-7).

This demonstrates Aristotle's view of how perception is important for both human beings and animals by leading them to distinguish between external objects. In fact, Aristotle was an empiricist in that he confirmed the importance of perception to knowledge. We can see this view at work in a number of different places in his works. It is an Aristotelian commonplace that if we perceived nothing, we would know nothing

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(Aristotle, *De Anima*: 432A3-10 also *Posterior Analytics*: 81A37-B6). If perception is so important for Aristotle's epistemology, our next inquiry is whether or not the content of our concepts is derived from our perceptions. In addition, we will be concerned with whether or not perception plays a role in Aristotle's logic which provides the foundation for his systematic knowledge.

When Aristotle discusses abstract objects, he points to his belief that concepts are derived from perception. For instance in his *Metaphysics* XIII, Aristotle discusses the ontological status of mathematical objects. In contrast to Plato, he argues that mathematical objects are not separate substances. Instead, a mathematical object is an abstract representation of a property of a sensible particular. As an example of that view, Aristotle argues that geometry treats concrete particulars qua lengths and it investigates the attributes that belong to objects qua planes, and qua lengths. A line is an abstract representation of the straight edge of some arbitrarily selected material object. (Aristotle, *Metaphysics*: 1078A2-31).

This view can be traced also in the *Metaphysics* when he discusses the relationship between species, genus and higher order universals, which consists in the degree of abstractness with which the features of the particular are conceptualized. All levels of abstraction in geometry and physics begin from external objects that we perceive by the senses. Now we shall turn to provide an answer to the question of whether or not perception plays a role in Aristotle's logic and his systematic knowledge. Here we find it is important to discuss Aristotelian logic, his theory of categories.

In his early work, Aristotle focuses on two tasks, firstly marking a limit of the role of particulars and universals in answering "what is it"? Secondly to inquire about things, and to defend the central role of natural-kind concepts in answering questions of both change and identity. The famous ten categories or predications are an attempt to enumerate the different ways we might characterize a particular in our experience: we might speak about its substantial nature, its quality, its quantity, its place, time, position, its relation, state, activity and inactivity. Aristotle's main point was that we do not pick things out and trace them as unclassified matter. For example, when we point to Socrates and say "what is it"? We are asking about a particular and it is that particular object that exists. That is why we identify and classify Socrates under the concept of "human

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being”. To explain and classify a certain particular is to say to what kind the thing belongs. The abstraction from similar particulars is the ground that forms Aristotle’s view on induction. Aristotle clearly argues in his *Posterior Analytics* for some sort of empiricist thesis when he discusses the problem of induction. It is a logical inquiry of how to derive a general concept out of similar individuals. Aristotle’s argument is clear enough to show how perception is important for induction. We can sum up his argument up in the following statement: there is no knowledge without induction, and no induction without perception, so no knowledge without perception:

Demonstration is from universals, and induction is from particulars, and it is impossible to contemplate universals except through induction... and induction is impossible for one not having perception. For perception is of individuals; for it is not possible to have knowledge of these, nor from universals without induction, nor through induction without perception. (Aristotle, *Posterior Analytics*:181A40-B9).

In this paragraph Aristotle makes perception the basis for the inductions that produce the universal concepts and propositions that are the proper objects of science. Therefore for Aristotle, induction is an instrument to link particulars and universals, or perception and a higher order of knowledge. It is true, according to Aristotle, that the external world acts on us through perception and afterwards the inductive process begins in perception to reach an abstract concept. For Aristotle, all universal knowledge comes about through perception, or a series of perceptions, through induction.

1.3 Empiricism and the Theory of Perception

In the following pages, I will present another account of perception associated with British Empiricism. My main interest in discussing British Empiricism is to give an insight of why Cassirer chose British empiricists as an example of showing the inseparable relation between them and Aristotle regarding the problem of perception. This will be demonstrated through our discussion of the two figures that represent empirical thought.

Empiricism is an original approach in the theory of knowledge. It identifies on experience as a source of knowledge and belief to explain facts regarding the external

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world and its objects. This is clearly elucidated in Locke's famous statement in his *Essay Concerning Human Understanding*:

Let us then suppose the mind to be, as we say, white paper, void of all characters, without any ideas; how comes it to be furnished? Whence comes it by that vast store, which the busy and boundless fancy of man has painted on it with an almost endless variety? Whence has it all the materials of reason and knowledge? To this I answer, in one word, From experience: in that all our knowledge is founded, and from that it ultimately derives itself. (Locke, 1867: Book 11, Ch 159).

Locke argued that experience is the ultimate source of all of our knowledge. He claimed that all our ideas; the immediate objects of perception, thought or understanding, spring from experience. (Locke, Essay II viii8).

For Locke, observation applies to perception of external and sensible objects, but also to the observation of the internal operation of our minds.

According to empiricists, the mind does not merely copy ideas of particulars, but applies internal mental capacities to abstract, associate ...etc. The mind is concerned not only with explaining the relationship between what is seen and what really exists, but is also concerned with the complex operation and the laws that combine the different ideas or sensations together.

Actually, even the British empiricists, the philosophers historically most identified with the copy theory of mind, recognized that the mind does not simply mirror nature. (Flanagan, 1992:xxx).

The mind has a positive role to play in the theory of representation. Therefore we are going here to discuss two different figures who presented different accounts concerning the above questions.

1.3.1 Berkeley's view of perception

To understand Berkeley's view of perception, we have to understand two important and general schemes on which he formulated this account. The first scheme is the empiricist base, which deals with the sensory experience. The second base is the metaphysical one, which provides him with the ultimate framework for understanding and explanation. Like other empiricists in the eighteenth century, Berkeley used the term "idea" mostly to refer to the immediate object of perception. Philosophers in the eighteenth century used the term "idea" to point out the immediate perception that takes place without inference. Berkeley's main argument against Locke's theory of abstracted ideas rests on the premise

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that we cannot conceive of the impossible (Berkeley, 1950: works vol2, 28). Berkeley argued that perceptual situations do not involve any kind of abstracted ideas and also that the doctrine of abstracted ideas is a false view that led individuals to suppose that there is matter or material substance. As a result, Berkeley presented his view on perception through his principle “Esse est percipi” that rejected the false claim of material substance.

Berkeley reduces the thing to its component elements, and shows that each and all of these consist in being perceived. A thing is nothing but an aggregate of sensible qualities, and, if we can show that none of these can exist apart from perception, we shall have proved that the existence of the thing itself consists in being perceived. (Johnston, 1965:179).

Berkeley distinguished two views in respect of the immediate perception; the philosophers’ view and the vulgar view. The vulgar view considers the things that they immediately perceive to be the real things. However the philosophers consider that the things they immediately perceive are mere ideas that exist only in the mind. In addition, Berkeley rejected the philosophers’ views that what we immediately perceive is just an idea existing only in the mind. Therefore, Berkeley presented his analysis of the nature of idea to go beyond both vulgar and philosophers’ views about the external objects.

Berkeley used the term “idea” to refer to immediate objects that can be considered the foundation of our knowledge. He divided “idea” into three kinds of ideas; sense-idea, ideas of reflection and finally the ideas of memory or imagination. Sense-ideas are apprehended by sense, ideas of reflection are those ideas which we are conscious of in our thoughts, desires, feeling and volition. Finally the ideas of memory or imagination are representations of both those kinds of ideas in either memory or imagination. Berkeley sought to ascribe an active role to an agent that contributes positively to the theory of knowledge. What is the active agent implied in Berkeley’s theory of knowledge?

Berkeley argues that there is something that knows or perceives ideas. He claims that the sense-idea is perceived by an active being which he describes as the mind or spirit. Berkeley ascribes an active role to the mind or spirit in perception. According to Berkeley, one needs to distinguish between two modes of being; the mode of being of

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what is perceived is distinct from the mode of being of the perceiver. In other words, what is perceived is the sense-phenomena and it is a passive object. Meanwhile, the perceiver is an active subject that perceives. In the light of that distinction, Berkeley's meaning of existence is derived. For Berkeley, the existence of the passive is to be perceived (*esse est percipi*), and the existence of minds or active things is to perceive (*esse est percipere*) and therefore existence in general, whether of passive things or active things, is necessarily related to the mind or the spirit (Luce, 1945: 58).

In regard to Berkeley's view of the external world, Luce claimed that the main point in Berkeley is that he was not skeptical about the existence of the external objects, but he was a realist and paid attention to the objectivity of the external world:

It is significant that he puts the object before the subject. The object is his first interest, his opening theme. Objectivity is the key-note of the Principles. He is not solipsist, nor subjectivist, nor subjective idealist; his starting-point is not the self, but the "it". Descartes begins with the *cogito ergo sum*, Berkeley begins with the *cogitatur ergo est*. He believed in the sensible world, as you and I do. He looked out on the Dublin mountains, and so do I as I write these words. (Luce, 1945:46-47).

In contrast to Luce's claim, George Pitcher argues that Berkeley is an idealist and believes existence of the object is in the mind:

We never perceive so-called physical objects-e.g. never see such things as tulips or rocks; we perceive only things that exist in our own mind. (Pitcher, 1977:144).

I agree with Luce that Berkeley was not a solipsist even though it could be deduced from some of his texts that he is a skeptic. How could one be sure that the data of immediate and mediate perception is reflecting the existence of the external objects? Berkeley argued that neither sense ideas nor idea of memory and imagination is responsible of having a belief of the existence of external objects like the sound of a coach we imagine that there is a coach approaching. We construct our idea of a coach from the perceptual data of immediate perception. Berkeley's concern was devoted to sense-ideas and how they represent the objects of the external world. He indicated that when someone is in his study, looking at his study table, he is not skeptical about the existence of the table. However, the question concerning the existence of the study table is provoked when our immediate perception of it ceases. For example, when I am away from my studying room would the study table be there and exist even though I do not immediately perceive it? (Berkeley, 1942: 28-29).

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Berkeley therefore argues that what is unperceived exists even though it is not an object of our immediate perception. As a result, Berkeley presupposes that there must be some external cause for our sense-ideas or sensation. This external cause is nothing more than God as being an immaterial substance. Berkeley sought to present a form of the causal theory of perception that may be described as “spiritual causation”. Hence, Berkeley claimed that this cause must be the substance that is independent of the objects we perceive where the objects of perception are dependent upon that substance. This substance, according to Berkeley, is not a material one, but a spiritual substance. Berkeley argued that no finite human mind could be responsible for my perceptual ideas. Only an infinite spirit could do the job:

Among spirits there is one infinite spirit, God; and there are many finite spirits, none of them....finite minds have small power to cause ideas; but when we observe the world around us, we are forever being affected with the ideas that God's mind perceives, and which by God's will finite spirits also perceive. (Berkeley, 1957: 39).

Berkeley claimed that the mind does not produce and imprint sense-ideas because it is finite and also the individuals always make different and subjective judgments on what they perceive. Therefore Berkeley explained that God or spiritual substance, produces the ideas of sense for us and imprints them on us. The ideas imprinted on the senses are not creatures of my will. There is some other spirit that produces them (Berkeley, 1957: 39). In other words, since no two persons perceive the same thing, it is God who causes the individual percipients to be affected by similar but not identical sensory phenomena. God, for Berkeley is the guarantor of what we perceive, and even if he is not immediately perceived by us at the moment, still exists in the external world (Hergenhahn, 1997: 199).

As a matter of fact, Berkeley did not claim that the object does not exist at all at the moment I am not seeing it. However, he argued that the object that I am not seeing subsists in the mind of an external spirit. Berkeley based his theory of perception on the assumption that what creates external reality is God's perception. It is the fact that external reality is God's perception that makes it stable over time and the same for everyone.

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The tree is a collection of ideas and every collection of ideas must exist in some mind, the tree must exist in an infinite mind or spirit. Berkeley concluded that the persistence of the tree gives us a good reason to conclude that there exists an infinite spirit, God. The tree continues to exist even at times when no finite spirit or ordinary person perceives the tree. Since the tree I presently see is a collection of ideas and is independent of finite spirit, it follows that there must be an infinite spirit (mind) upon which the tree depends for its continued existence. (Warnock, 1969: 89-90).

1.3.2 Hume's View of Perception

Hume differentiated himself from traditional empiricism by drawing a distinction between epistemological views which would reflect his view on perception. Like Locke and Berkeley, Hume confirmed the importance of experience in the problem of knowledge. Hume's aim was to comprehend human mind and its cognitive operations and to avoid all those questions which transcend human understanding. Hume insisted on not going beyond the experience because it is considered the only reliable source for our knowledge:

We must endeavour to render all our principles as universal as possible, by tracing up our experiments to the utmost, and explaining all effects from the simplest and fewest causes, tis still certain we cannot go beyond experience; and any hypothesis, that pretends to discover the ultimate original qualities of human nature, ought at first to be rejected as presumptuous and chimerical. (Hume, 1960: xxi).

He also adds in his Enquiry:

It is only experience, which teaches us the nature and bounds of cause and effect, and enables us to infer the existence of one object from that of another. Such is the foundation of moral reasoning, which forms the greater part of human knowledge, and is the source of all human action and behaviour. (Hume, 1975: 164).

Hume could push the empirical approach a step further than Locke and Berkeley by transcending all notions which transcend our experience. Therefore He objected both Locke's idea of substance and Berkeley's idea of the spiritual substance. In addition, he also objected these ideas raised by rationalists and found its place within empiricism, like the concepts of space and causality:

It seems... not impossible to avoid these absurdities and contradictions, if it be admitted, that there is no such thing as abstract or general ideas, properly speaking; but that all general ideas are, in reality, particular ones, attached to a general term, which recalls, upon occasion, other particular ones, that

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resemble, in certain circumstances, the idea, present to the mind.... If this be admitted (as seems reasonable) it follows that all the ideas of quantity, upon which mathematicians reason, are nothing but particular, and such as are suggested by the senses and imagination, and consequently, cannot be infinitely divisible. (Hume, *Enquiry* Quoted Wilbanks, 1968: 111).

Hume was concerned with the question of whether the nature and the essence of metaphysical concepts like God or the external world could be known. Is there any faculty that allows to grasp knowledge of objects going beyond experience? Could our understanding provide us with proper answers based on our own experience of these objects? Once he put these two questions in his account, therefore we can claim that his system includes two different methodological approaches. The first one is the destructive approach, which tries to criticize and to remove all kind of metaphysical thought, and the second approach is the constructive one that seeks to discover the faculties of human understanding and their roles of knowledge.

Hume can be seen as a positive philosopher who introduced fresh analysis to some philosophical problems such as his analysis of causality and his attempt to construct a theory of the mind. He could also be seen as a negative philosopher because of his skepticism about the reason and the method of composing abstract ideas along with his theory of imagination, as we shall discuss later. As a result, Hume's philosophy could be analyzed in the light of these two approaches. Most of philosophers read Hume as being a negative and a destructive philosopher, while a few like Norman Kemp Smith read him as a positive and a constructive philosopher (Smith, 1964).

1.3.3 The problem of Perception

Hume indicated that perception could be understood through impressions and ideas, which are the only possible sources for us to obtain knowledge. He distinguishes between impressions and ideas with the claim that the former have a greater degree of force and liveliness than the latter. In addition to that difference, ideas, as a mental content of our mind, are considered simpler than impressions:

All the perceptions of the human mind resolve themselves into two distinct kinds, which I shall call Impression and Ideas. The difference betwixt these consists in the degrees of force and liveliness with which they strike upon the mind and make their way into our thought or consciousness. Those

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perceptions, which enter with most force and violence, we may name impressions.... By ideas I mean the faint images of these in thinking and reasoning. (Hume, 1960: 1).

Hume argued that ideas are weak and feeble perceptions because they are derived from impressions. Moreover, we can claim as Hume did, that ideas are mere copies of impressions (Hume, 1975: 19 also Flew, 1986: 23-24). Here we can find out the first assumption of Hume's theory of perception which can be summarized as follows; nothing can be perceived unless we experience it. Hume asked how we could apprehend something which goes beyond our experience.

Therefore I claim that it was Hume who successfully closed the gap which was found in Berkeley's theory by going beyond the idea of spiritual substance and maintaining Berkeley's principle *ESSI IS PERCIPPI* not as a metaphysical principle. This understanding explains why Hume rejected the idea of miracles and super-powers existing within religion. For maintaining his theory of perception away from any metaphysical claims, Hume formulated a proper definition of the mind by which he closed the door to any view that could define it in terms of substance. Hume defines the human mind as a collection or bundle of perceptions. We do not have any knowledge of the mind and its nature except what we know about it, as a group of ideas, which are related to each other. (Broaches, 2002: 200-201).

Hume did not need any additional principles to explain perception. Here I agree with Ayer that to explain perception in the light of these two sources: impression and ideas, it was necessary for Hume to consider impressions as a primary and a primitive source for his theory (Ayer, 1989: 40). The next question is how these separated impressions could be related in order to represent an object, and whether these impressions relate haphazardly or according to laws.

1.3.4 The Associative laws of Perception and the Problem of the External World

The role of the mind is to relate the contents of experience. Therefore the mind needs certain laws of association and to relate all those different ideas under one object. Unlike

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Kant, Hume did not attempt to explain how association arises. Rather, Hume accepts association as an observed fact grasped in experience. Hume asked what the principles of this association are and he found that all our ideas stand in three relations; resemblance, contiguity and cause and effect. For instance, mind finds it is easier to associate ideas that are contiguous in time or place together:

Tis plain, that in the course of our thinking, and in the constant revolution of our ideas, our imagination runs easily from one idea to any other that *resembles* it, and that this quality alone is to the fancy a sufficient bond and association. Tis likewise evident, that as the senses, in changing their objects, are necessitated to change them regularly, and take them as they lie *contiguous* to each other, the imagination must by long custom acquire the same method of thinking, and run along the parts of space and time in conceiving its objects (II). (Hume, 1975: Quoted from Laird, 1932:43).

These are the associative ideas that relate our impressions or ideas of perceived objects.

The importance of Hume's theory of perception was that he went one step further than Locke and Berkeley by setting up a causal explanation of perception by showing the internal workings of the mind. The principle of causality will cause him serious trouble. It does not deal with perceptions, which can be either seen or felt but with perceptions which would be inferred from other perceptions which are not under our sensory experience: the problem of how we infer from perceived objects to the existence of some objects which are not seen by our immediate sensory observation.

Hume explains his theory of the external world and its relation to perception in his *Treatise* in book I part IV section II, "Of scepticism with regard to the sense", and in section IV "Of the modern of philosophy" and in section V "Of the immateriality of the soul". He indicates that every impression and every idea, which we have either in our mind or memory, does not include any mark of existence. The idea of existence neither increases nor diminishes the idea. According to Hume, if we take the example of my own body, it is nothing more than a group of sensible percepts that are related together. My experience shows me that my body is those percepts which I have about it. Therefore it was interesting to ask questions about its nature and whether it has an existence independent of those percepts. For Hume, attempting to answer these questions would lead us beyond experience.

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Hume's aim, throughout his discussion of the external world, is to transcend the ontological problem implied in perception that leads individuals to ascribe a continuous, distinct and an independent existence of objects that we no longer perceive or cease to perceive. To solve this ontological problem, it was necessary, according to Hume, to differentiate between two different views of our perception of external objects; the philosophers' view and the vulgar view. According to the vulgar view the objects and our perception of them are the same. However, philosophers distinguish between objects that are directly perceived and ascribed a continued and distinct existence to our sensible perception of objects that cease to be perceived.

Regarding this distinction between Vulgar and Philosophers on perception, Hume asked two important questions. Firstly, why do we attribute a continued existence to objects we have perceived, even when they are not present to the senses? Secondly, why do we suppose them to have an existence distinct and independent from perception? Therefore Hume examined the faculties of our mind which are responsible for ascribing continued and independent existence to perceived objects. He investigates the senses, reason and imagination to show which faculty is in charge for carrying out the belief of the existence of external objects.

For senses, Hume argues that senses are not responsible for the belief of continued existence of objects. Hume summarized that conclusion as follows:

Thus I resume what I have said concerning the senses; they give us no notion of continued existence, because they cannot operate beyond the extent in which they really operate. They as little produce the opinion of a distinct existence, because they neither can offer it to the mind as represented, nor as original. To offer it as represented, they must present both an object and an image. To make it appear as original, they must convey a falsehood; and this falsehood must lie in the relations and situation: in order to which, they must be able to compare the object with ourselves; and even in that case they do not, nor is it possible they should, deceive us. We may therefore conclude with certainty that the opinion of a continued and of a distinct existence never arises from the senses.(Hume, 1960: 191-192).

We could see here that the senses are not the faculty that can justify the idea of a distinct existence of an object apart from perception. Therefore Hume examined another faculty reason and came to the conclusion that reason can not justify our belief in a distinct existence of an unperceived object.

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Hence, the belief must be caused by the imagination. (Buchdahl, 1969:349 -350).

Hume developed two notions that explain the belief of the external existence of our perceptible objects: constancy and coherence. Constancy can be defined as an idea that results in our belief in a certain object, which we directly perceive, even if that object is not being instantly perceived by us:

All those objects, to which we attribute a continu'd existence, have a peculiar *constancy*, which distinguish them from the impressions, whose existence depends upon our perception. Those mountains, and houses, and trees, which lie at present under my eye, have always appeared to me in the same order; and when I lose sight of them by shutting my eyes or turning my head, I soon after find them return upon me without the least alteration. My bed and table, my books and papers, present themselves in the same uniform manner, and change not upon account of any interruption in my seeing or perceiving them. (Hume, 1960:194 -195).

Along with constancy, Hume used another idea that was coherence: the perception of something we have perceived for a long time remains unchanged even though slight changes have taken place but we do not recognize them and maintain the previous images that we perceived. For example being away from an object that has not been perceived by me for a long time, I believe that the object still exists during my absence:

Bodies often change their positions and qualities, and after a little absence or interruption may become hardly knowable. But here 'tis observable, that even in these changes they preserve a *coherence*, and have a regular dependence on each other.... When I return to my chamber after an hour's absence, I find not my fire in the same situation, in which I left it: But then I am accustomed in other instances to see a like alteration produced in a like time, whether I am present or absent, near or remote. This coherence, therefore, in their changes is one of the characteristics of external objects, as well as their constancy. (Hume, 1960: 195).

Hume's theory of imagination was the tool to answer the question of what causes us to believe in the existence of the body. According to Hume, the faculty of imagination explains, but does not justify our belief in the distinct and independent existence of external objects. Therefore, I consider Hume's theory of imagination as a premature tool to justify the belief in the external existence of the objects where he made use of his doctrine of the association of ideas. For example, he referred to the lively impressions of the memory where one still believes the objects that are no longer perceived still exist independently in the external world.

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In fact, the term imagination is the keyword in Hume's whole theory of perception. He could not realize the cognitive power of imagination and could not reach its high levels by distinguishing, like Kant, between the transcendental imagination and the empirical imagination. Hume did not recognize the synthetic activities of the imagination. Hume was satisfied to analyze perception in the light of the limited role of imagination where the role is to associate between sense impressions and the ideas of memory. The role of imagination here is limited comparing to the role given to it in Kant's theory of imagination as we shall discuss later.

1.4 Kant and the Transcendental Perspective of Perception

Kant's goal in the Critique was to show how the content of our experience must exhibit a definite connectedness and relational structure. Therefore, he argued that objects of thought are nothing more than centers of such connectedness and structures. Kant claimed that these kinds of relations and forms of connection are not inherent in reality, but these relations rest on the synthesizing activity of the transcendental subject which organizes our experience using certain a priori categories. Kant brought about the idea of the transcendental perspective that studies the structure of the mind showing how its faculties play a systematic role in the elements of experience. The importance of the transcendental view was to confirm the active and systematic role of the mind which had been ignored by the empiricists. The mind is not a passive agent for collecting and joining various impressions as the empiricists claimed. Kant would argue that the mind has the principles and structures which provide the basis for arranging and ordering the elements of experience:

Kant agreed with the British empiricists that sensations precede knowledge. However as soon as we have sensations, they are modeled by the mind's structure, which is a priori, that is before the sensations. The mind for Kant was not a passive entity shaped by experience. Rather, the mind is an active agent, coordinating sensations into perceptions and perceptions into knowledge, changing manifold experiences into the unity of thought. (Thorne & Henely, 1979: 106).

We are going to argue in the following pages that Kant's contribution to perception was to demonstrate the systematic unity of the mind and how the mind provides perceptual

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experience with the principles needed to organize its objects. Therefore I will discuss Kant's theory of perception clarifying the components of his theory and the validity.

1.4.1 Kant's Theory of Perception

Kant's view on perception has been illustrated throughout the Transcendental Aesthetic in which he constructed the formal framework of sensible manifolds. Kant sought to represent a different answer to Hume's problem of how we justify the existence of unperceived objects through a critical analysis of the faculties of the mind. Before I discuss his theory of perception, I would like to emphasize two points that played a significant role in forming his account of perception. The first point was his disagreement with Hume's view regarding the causal principle. Kant believed that the principle of causality has a universal validity and not a matter of habit. The second point was derived from his metaphysical situation: there was agreement between Kant and Hume on the impossibility of knowing ideas such as God and the soul since they are not presupposed in experience.

To perceive an object, Kant claimed that two faculties of the mind are required. These two faculties are sensibility and understanding. Sensibility, according to Kant, is the passive part of the mind and its function lies in receiving intuition. Understanding is an active faculty of the mind, the function of which is to bring order to intuition and perceptual experience.

Let us give the name of sensibility to our mind's receptivity, [i.e., to its ability] to receive presentations insofar as it is affected in some manner. Understanding, on the other hand, is our ability to produce presentations ourselves, i.e., our spontaneity of cognition. Our intuition, by our very nature, can never be other than sensible intuition; i.e., it contains only the way in which we are affected by objects. Understanding, on the other hand, is our ability to think the object of sensible intuition.

(Kant, 1996: A51).

Kant argued that sensibility and understanding are necessary conditions for each other to the extent that intuitions, considered to be the matter of knowledge, are blind without concepts, and concepts, the forms of knowledge, are empty without intuitions.

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For Kant, the object of perception is not a mere association of some properties that we abstracted from similar objects, rather it presupposes some rules or forms that give it its unity and coherence. To combine quality into a unity is an act of the understanding or a synthesis. To perceive an object, according to Kant, there are three basic processes of synthesis that are necessary conditions, although perception must not be viewed as a process that takes place in three separate stages. Rather, they are considered to be three constructive aspects of a single active process of the mind. In fact, Kant sought to simplify the active process of the mind by dividing it into three constructive aspects as follows; the synthesis of apprehension, the synthesis of reproduction and finally the synthesis of recognition. These three kinds of synthesis concern intuition, imagination and concept respectively. Let us now discuss, according to Kant, what exactly occurs in our mind when we perceive an object.

1.4.2 The Synthesis of Apprehension

In the *Transcendental Aesthetic*, Kant argued that sensibility should be considered as the faculty of receptivity that receives the empirical intuitions. However, Kant found that the empirical intuitions received by sensibility are not ordered. He claimed that the act of ordering the empirical intuitions requires a priori forms. The question Kant asked was how can sensibility supply us with a priori forms? Kant gave his answer that there are two pure forms of sensible intuition: space and time, in which our actual sensations occur. Space and time are presupposed before experience itself.

Time and space are, accordingly, two sources of cognition. From these sources we can draw a priori different synthetic cognition.... For time and space, taken together, are pure forms of all sensible intuition, and thereby make synthetic propositions possible a priori. But precisely thereby (i.e., by being merely conditions of sensibility), these a priori sources of cognition determine their own bounds; viz., they determine that they apply to objects merely insofar as these are regarded as appearances, but do not exhibit things in themselves. Appearances are the sole realm where these a priori sources of cognition are valid; if we go outside that realm, there is no further objective use that can be made of them. (Kant, 1996:A39).

For Kant, space is a necessary a priori presentation that underlies all outer intuitions. It always precedes our perception of external objects because we cannot perceive an object if it is not ordered in space. In fact being a necessary a priori form of presentations does not allow Kant to consider it as a universal concept of things. He

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considers space only as a priori form for the outer sense or presentations. From that epistemological situation, Kant could go beyond the debate between Newton and Leibniz on the origin of space. Space, according to Kant, is neither a preexisting container in which objects are placed, nor is it a pure system of relationships among objects. But it is a priori form of human perception

Space is nothing but the mere form of all appearances of outer senses; i.e., it is the subjective condition of sensibility under which alone outer intuition is possible for us. Now, the subject's receptivity for being affected by objects precedes necessarily all intuitions of these objects. Thus we can understand how the form of all appearances can be given in the mind prior to all actual perceptions, and hence given a priori; and we can understand how this form, as a pure intuition in which all objects must be determined, can contain, prior to all experience, principles for the relations among the objects.

(Kant, 1996: B42).

The same understanding is also applicable to time. For Kant, the concept of time cannot be developed directly from experience of events taking place simultaneously or successively because these two notions of simultaneity and succession presuppose time. We cannot refer to simultaneous events or successive events unless we have the concept of time that implies these two notions. Therefore, Kant considered time as a necessary condition that underlies all intuitions. Space and time are to be considered as two subjective conditions of intuitions which cannot be detached from each other when we perceive two external objects sequentially following each other. The mind has to arrange the empirical intuitions in spatial and temporal orders.

Kant calls the act of gathering the manifold under space and time "*the synthesis of apprehension*". This kind of synthesis is important for knowledge, but alone is not enough to let the mind acquire knowledge about the objects perceived.

1.4.3 The Synthesis of Reproduction

Kant in this section begins to take his analysis further to reflect the constructive and active function of the mind. Kant aimed to show the structuralism of the mind by showing the synthesis of reproduction is not detached from the synthesis of apprehension. The synthesis of reproduction takes place in the mind through the imagination

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Hence the synthesis of apprehension is linked inseparably with the synthesis of reproduction. And since the synthesis of apprehension constitutes the transcendental basis for the possibility of all cognitions as such (not merely of the empirical but also of the pure a priori ones), the reproductive synthesis of the imagination belongs to the transcendental acts of the mind; and, on account of this involvement of the imagination, let us call this power the transcendental power of imagination. (Kant, 1996: A102).

Kant felt that there is a gap between sensibility and understanding and that is why he wanted to bridge that gap by presupposing the faculty of imagination. The role of imagination can be seen clearly in his theory of perception where Kant claimed that perception requires the synthesis of productive imagination. Kant used to call this sort of synthesis the pure transcendental synthesis of imagination, and considered it as conditioning the very possibility of experience. However, Kant later reconsidered the synthesis of imagination and called it the “synthesis of productive imagination” instead of the transcendental synthesis of imagination (Gibbons, 1994: 24). This transition makes one of the most significant differences between Kant and Hume on imagination. In his early thought, Kant agreed with Hume on the function the imagination performs in the mind. Hume and the early Kant gave an inactive role to the imagination: its role was to combine and bind sense data into a single concept. It followed that the role of imagination was to associate the past representations with the present representations as in Hume’s concept of coherence. However, in his later work Kant transcended that passive role played by the imagination and ascribed to it an active role through his synthesis of imagination by considering that imagination implies a rule that unifies the representations and gives the imagination a more active role to represent the perceived objects. Kant believed that representations have to be related according to certain rules that make the reproduction of representation possible. Therefore, he indicated that this rule is the a priori basis of a necessary synthetic unity. (Kant, 1996: A101).

The phrase “reproductive synthesis of imagination” means that imagination does not produce what it associated together before as mere aggregation but re-associates the presentations in the light of rules. Therefore Kant distinguishes between image and schema in imagination. An image means presenting an object exactly as we perceive it. The imagination here just produces what it perceived before. In contrast, a schema is a

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reproduction of what is perceived according to a rule. In this case, we do not need the immediate presence of the direct object to perceive it, but the mind still can present the object under a general rule. I will refer to one Kantian example to emphasize the difference between an image and a schema in the *Critique of Pure Reason*:

Thus if I put five dots after one another, like this, ,then this result is an image of the number five. Suppose, on the other hand, that I only think a number as such, which might then be five or a hundred. Then my thought is more the presentation of a method for presenting- in accordance with a certain concept- a multitude (e.g., a thousand) in an image, than this image itself. Indeed, in the case of a thousand I could hardly survey that image and compare it with the concept. Now, this presentation of a universal procedure of the imagination for providing a concept with its image I call the schema for the concept. In fact, it is schemata, not images of objects, that lie at the basis of our sensible concepts.... The concept of *dog* signifies a rule whereby my imagination can trace the shape of such a four- footed animal in a general way, i.e., without being limited to any single and particular shape offered to me by experience, or even to all possible images that I can exhibit. (Kant, 1996: A141).

Some commentators have emphasized the importance of the synthesis of imagination as a necessary part of perception. In his *Imagination and Perception* Strawson re-used Kant's example of the dog to confirm the difference between image and concept. He claimed that the perception of a dog implies that we see the dog as a dog, but there is another alternative that involves having the thought of other possible perceptions related to our actual perception as perceptions of the same object. To see it as a dog, silent and stationary, is to see it as a possible mover or barker. (Strawson, 1982: 82-99).

We could see to that extent how Kant distinguished his account of perception from Hume's account. No doubt that active role of imagination will reflect positively on the faculty of understanding. Therefore the imagination with its active role bridges the faculty of sensibility and the faculty of understanding.

1.4.4 The Synthesis of Recognition

The synthesis of recognition represents the third aspect of Kant's structuralism concerning perception. Along with imagination, it represents the positive aspect of the mind. In his *Critique of Pure Reason* Kant defines understanding as the following:

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The unity of apperception [considered] *in reference to the synthesis of imagination* is the understanding, and the same unity as referred to the *transcendental synthesis of imagination* is *pure understanding* (Kant, 1996:A119).

Kant claimed that the representations must be capable of being recognized in light of the *a priori* rules of the understanding. The concepts of understanding must give unity to the representations. The object we perceive is not a mere sum of presentations: the object as a subject of our knowledge presupposes the unity of consciousness:

We are, however, dealing only with the manifold of our presentations. And since that *x* (the object) which corresponds to them is to be something distinct from all of our presentations, this object is nothing for us. Clearly, therefore, the unity that the object makes necessary can be nothing other than the formal unity of consciousness in the synthesis of the manifold of the presentations. When we have brought about synthetic unity in the manifold of intuition- this is when we say that we cognize the object. This unity is impossible, however, unless the intuition can be produced according to a rule a [certain] function of synthesis, viz., a function of synthesis that makes the reproduction of the manifold necessary *a priori* and makes possible a concept in which this manifold is united. Thus when we think of a triangle as an object, we do so by being conscious of the assembly of three straight lines according to a rule whereby such an intuition can always be exhibited. Now *the unity of the rule* determines all that is manifold, and limits it to conditions that make possible the unity of appearances all that is manifold, and limits it to conditions that make possible the unity of apperception.

(Kant, 1996:A105).

In perception the mind presupposes a rule and, according to it, the representations must be ordered. For instance, Kant gave an example of the ways that the mind orders the representations as in the case of perceiving a house as one case and a ship floating down to the river as another case. We can perceive it through different possible orders since I can perceive it from the right or from the left. In addition, the mind can apprehend our perception of the house by apprehending the manifold of the empirical intuitions by starting from top to the end or the bottom as another way of apprehending the perception of the house. On the contrary, the mind cannot apprehend our perception of a ship sailing down to the river in more than one way. For our apprehension of the ship in motion is determined by an order of succession. I mean that perceiving the ship is submitted to *a priori* order that is succession. This order forces the perceivers to perceive the top of the ship before the bottom. (Kant, 1996: A192).

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Kant explains the differences between the last two examples, by distinguishing *subjective succession* as in the case of the house, and *objective succession* as in the case of the ship. According to Kant, subjective succession does not follow a particular order and cannot distinguish one appearance from another. However, objective succession means that the appearances are ordered. In other words, among the representations of what we perceive, the appearance of the one item succeeds the apprehension of the other in respect to a rule (Kant, 1996: A193).

Kant claimed that the possibility of experience presupposes a transcendental unity of consciousness. In other words, cognition itself is impossible without presupposing the unity of consciousness that precedes all data of intuition (Kant, 1996: A107). Kant distinguished between this transcendental unity of consciousness and the empirical unity of consciousness that takes place in sensibility. Kant calls the transcendental unity of consciousness the transcendental apperception and the empirical unity of consciousness the empirical apperception. Kant indicates that this transcendental unity of consciousness lies a priori at the basis of all concepts. This distinction was a result of the Kantian distinction between an “empirical object” and a “non-empirical” object. The former refers to an object that we can directly perceive in a perceptual situation. Non-empirical objects are those that are theoretically developed or cannot be perceived directly. For example, x as an object of knowledge does not refer to a particular object. These kinds of objects are the objects of cognition and are those objects that Kant calls “the transcendental objects”.

These transcendental objects depend on the transcendental laws of the understanding and hence it is a decisive step toward the objectivity of reality. The mind depends not on the objects of intuition, but on transcendental objects:

The pure concept of this transcendental object (which object is actually always the same, $= x$, in all our cognitions) is what is able to provide all our empirical concepts in general with reference to an object, i.e., with objective reality. Now this concept cannot contain any determinate intuition whatever, and hence presumably pertains to nothing but that unity which must be encountered in any manifold of cognition insofar as this manifold has reference to an object. This reference, however, is nothing but the necessary unity of consciousness, and hence also of the synthesis of the manifold brought about through the mind's concerted function of combining this manifold in one presentation. Now this unity must be regarded as necessary a priori (because otherwise cognition would be without an object); and

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hence the reference to a transcendental object, i.e., the objective reality of our empirical cognition, presumably rests on a transcendental law. (Kant, 1996: A109).

Moreover, Kant claimed that the transcendental unity of consciousness is impossible if there is no subject that is aware of that unity. In other words, Kant aimed to show that, in order to recognize representations as synthesized according to a concept, the subject must be able to recognize itself as combining these representations in a single consciousness. Kant in (A108) claims that knowing an object by conceiving it as falling under an a priori rule involves the original and necessary condition of the identity of the self. Kant was concerned to emphasize the importance of unity over variety, and the function the latter performs in ordering and arranging the various elements of perception into different unitary forms. Therefore I consider the unity of consciousness as another attempt by Kant to confirm his view that the mind implies unitary and universal orders to arrange our perceptual experiences. We can see, from this discussion, how the faculty of understanding plays an important role in Kant's theory of perception, constituting an objective explanation of physical reality and its objects.

To sum up, Kant developed an account of perception emphasizing the active role of the mind and the way in which the mind constructs its objects. He could link the passive function of receptivity, or "sensibility", and the active function, or the "understanding" by bridging them using the "imagination" confirming the active and structural role it performs in perception. Kant could present a more positive view than Hume concerning imagination. In addition, Kant presented an account of perception giving an important concern to the structural aspect needed to formulate a view of perception where the importance is given to rules and orders that organize the representations.

Cassirer and Functional-Relational Thought

2-1 Introduction

In the first chapter we attempted to discuss various views of perception. However, in order to have a complete view of the theory of perception we need to discuss a different view based on another logical perspective: Cassirer's view of functional-relational thought. This chapter will focus on determining the basic process of how, in Cassirer's view, scientific concepts are formed and the contrast between what Cassirer calls "substantial thought" and "functional-relational thought" and finally the symbolic realms of experience. The steps we have chosen seem very important, since they reveal Cassirer's view of the real nature of scientific concepts. The problem of scientific concept formation requires a plausible solution in respect to logic and the critique of knowledge. In this analysis, we shall discuss the different aspects of functional-relational thought that determine the structure of scientific concepts, and reconstruct the relation between object and scientific law. In addition, we shall argue that Cassirer's theoretical perspective passed through three main stages; Berlin, Hamburg and Immigrations where an epistemological break took place in the end of Berlin stage between Cassirer and the idealistic instructions of the Marburg School.

2-2 Cassirer and The Marburg School

Cassirer is considered to be one of the younger members of the so-called Marburg School that includes both Hermann Cohen (1842- 1918) and Paul Natorp (1854-1924). This school was one of various Neo-Kantian schools that worked under the influence of Kant. Recently, researchers have expressed different views concerning "*Neo-Kantianism*", for example T.K. Oesterreich in his article Neo-Kantianism distinguishes seven different approaches to Neo-

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Kantianism; physiological, metaphysical, realistic, logicist, an approach based on values Wilhelm Windelband (1848-1915) & Heinrich Rickert (1863-1936), a relativist approach (George Simmel) and a psychological approach (Leonhard Nelson). (Bochenski 1957, 88-89).

Some researchers like Hans Ludwig Ollig reject these classifications because they contain some ambiguities. He therefore divides Neo-Kantianism into two basic schools; the Marburg School (Hermann Cohen) and the Southwest German School (Wilhelm Windelband) and claims that these two schools are based on systematically oriented works on Kant (Ollig, 1998: 776). The Neo-Kantian schools came into existence as a school of thought as a result of both Edward Zeller (1814-1909) and Otto Liebmann (1842-1918) who in 1865 argued “Kant und die Epigonen” or “Back to Kant” in an attempt to capture the real meaning of transcendental philosophy and at the same time to stop the spread of the German idealism that emerged after the death of Kant and which misinterpreted the Kantian notion of the thing in itself. In addition, Neo-Kantians hoped to find a key in the Kantian philosophical spirit to lead them towards a new understanding of the developments of modern sciences. In Edward Zeller’s 1862 lecture in Heidelberg “*über Bedeutung Aufgabe der Erkenntnistheorie*” or “On the Significance and Task of Theory of Knowledge” he called for a return to epistemology. Zeller accused German idealists like Fichte, Schelling and Hegel of distorting the Kantian instructions by applying transcendental ideas which go beyond the faculties of our reason and demanded that these philosophers should return to Kant. The major aim of Neo-Kantians is to understand the different aspects of our experience in the light of Kantian transcendental philosophy. Although the Neo-Kantians are influenced by the Kantian spirit, they found it necessary to go beyond Kantianism in addressing some of the philosophical problems.

This philosophical situation has been indicated by the famous dictum of Windelband when he stated: “to understand Kant is to go beyond him”. (Pulkkinen, 2001: 100). The Neo-Kantians aimed to present new solutions to some philosophical problems raised by Kant. Therefore their interest focused on presenting the realm of phenomena by finding valid constructive forms to set up the judgments. Here I claim that the real meaning of the

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“Critique of Knowledge” for them was to find comprehensive forms that organize experience. Therefore, we can find some common characteristics that connect the Neo-Kantian different views. The first characteristic is their objection to any form of metaphysics, particularly the “Ding an sich” or “thing in itself”. They consider the ultimate aim of philosophy is to deny its explanatory role. (Saltzman, 1981: 25). Moreover, they were opposed to post-Kantian thinkers like Hegel and Fichte, who presented their understanding of objects and reality in a very restricted form of absolute idealism. They claimed that the world could only be understood through realizing that the world is the concrete actualization of concepts that are in mind. This idea in fact connects them with Kant, but they go beyond Kant. They sought to explain variety through one general principle, in other words they wanted to reduce the plurality of objects to a unifying universal principle.

They argued that the world is the construction of one universal mind or reason. The absolute idealists sought to go even beyond the Kantian dualism between sensibility and understanding, between matter and form by claiming instead a *developmental monism*. As a result, developmental monism is considered to be nothing more than a unifying principle that has different names, like ego, reason and absolute. Reality for them becomes a developing and organic whole whose principle can be grasped and whose unity could be articulated in philosophical systems. For example, Fichte considers the world and its objects to be a construction of the Ego or a product of I. (Fichte, see Breazeale 1992: 228). Therefore, we have two different accounts of Fichte’s idealism: it can be ascribed to absolute idealism where reality will be understood as existing only for an absolute ego. Alternatively, Fichte’s account can be ascribed to subjective idealism where reality will exist only for some finite ego or for an individual. (Beiser, 1902: 61, also Martin, 1997: 40).

Fichte wanted to develop Kant’s critical philosophy into a system of his own which he named “theory of science”. The task of philosophy, according to Fichte, is to provide a transcendental illustration of ordinary consciousness and every day experience (Pippin, 1989: 42-59 also Kneller, 2003: 35-38).

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Hegel defended the idea of a unified theory of reality but not by Kantian principle. He was convinced rather that there is another single principle that can systematically explain all forms of reality, not only physical forms but also organic life and all social and political forms, along with cultural and artistic achievements. In addition, Hegel considered that the fundamental principle that explains all reality is reason. Indeed, Hegel does not understand reason as a single entity, or a quality that is attributed to some human subject. Rather it is the sum of all reality. Hegel went a step further by claiming that reason and reality are strictly identical. This means for Hegel, that only reason is real and the only reality is reasonable (Pinkard, 1994: 46-48 also Mure, 1965: 91-99). Let us discuss the Marburg School view as apposed to the German idealists.

Although the Marburg School rejected the German idealists' developmental monism as a way of interpreting the world, the members of Marburg School believed that the world can be explained through the laws of thought. They took thought as their starting point and considered that thought has no origin outside itself. Their logical monism refers to the view that they, in contrast to idealists, do not represent the absolute beyond the logical forms of knowledge but all objects are represented through laws. Another difference between the Marburg School and the idealists is that, even though they agreed with the idealists in extending the Kantian Critique to include some other aspects of culture and civilization, they did not restrict themselves to the problems of exact sciences like Kant, but slowly applied the Critique project to domains of culture. This qualitative step taken by Natorp and Cassirer will be discussed through this chapter.

However, the Marburg School rejected the idealists' solution to explain the different aspects of culture by reducing it to an explanatory principle. This cannot be justified as it lies in the circle of metaphysics. The Marburg School rejected the idealist's view that philosophy can present reasonable answers about the physical world and can rationally explain truth about an essentially spiritual world.

The Neo-Kantians believed that the future of philosophy lies in implementing the transcendental method and the critique of knowledge to every possible form of human experience. They extended the critical question of how synthetic a priori judgments are

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possible, to include the question of how syntheses of ethical, religious and scientific judgments are possible. Having that understanding, they argued that knowledge is possible only through systematic methods based on constructive laws. The task of philosophical thought is to present the unique laws that can organize the chaos of phenomena. In other words, it is a presentation of the relation between form and matter, the universal and particulars.

The object of knowledge is now dissolved in a network of relations submitted to rules. The logical determination of the object of knowledge leads always to an original relation that is comprehended in a specific formula that is the formal relationship between contents and normative validity. Therefore Cohen and the other members of The Marburg School claimed that the rules supposed are universal rules supported by the judgments of logic and reason. Now we are going to discuss the philosophical background of The Marburg School in which Cassirer's views formulated.

The work of Cohen, Natorp and Cassirer was a logical extension of the Kantian Critique because like Kant, they sought to trace the *a priori* moments which make our experience possible. Therefore, they developed a theory of experience that can be seen in Cohen's 1871 Kant "*Theorie der Erfahrung*" or "Kant's Theory of Experience" and in Cassirer's contribution in the field in which he established his view on experience as an "invariance theory of experience". Cohen sought to trace those *a priori moments* not only in scientific experience but also in both ethics and aesthetics. The same view has been developed by both Natorp and Cassirer when they aimed to reveal those *a priori elements* in religion and the various domains of culture. This comprehension of Kantian spirit maintained by Cassirer is also applied in his talk in 1929 at Dövas, when the controversial debate took place between Cassirer and Heidegger concerning the whole aim of Kant's critique. Cassirer found that Heidegger's interpretation of Kant was expressly directed against a Neo-Kantian interpretation. Heidegger explained that Neo-Kantianism is the view that identifies philosophy with theory of knowledge. However Heidegger rejected a Neo-Kantian approach regarding their interpretation of Kantian Critique, because Heidegger claimed that the Critique of pure reason is a major work, it is an enterprise for exploring

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Being and metaphysics, not only an enterprise for exploring scientific knowledge as claimed by the Marburg School. (Gorner, 2000:95-96).

Both Cassirer and Heidegger gave concern to the problem of Man considered by them as the main issue of the Kantian Critique. Heidegger was concerned with being and the core of his being and time consists of an inquiry that starts out by examining our own concrete existentiell ways of being at the current moment. Heidegger sought to give an account of human existence. For Heidegger, to be a human is to be initiated into the practices and conventions of the society into which we are thrown. Similarly, Cassirer sought to give an explanation of the human from a Neo-Kantian background, which depended on giving a definition of Man. Cassirer's concern about man can be traced in his 1944 *An Essay on Man*, similarly to Heidegger's 1927 *Being and Time*.

Cassirer emphasized the spiritual law, the form, by means of which man liberates himself from his immediacy and his anxiety. This is the way in which the finite mind participates in the infinite. Whereas Heidegger expounded his book on Kant and the problem of metaphysics, which had just been published. He expressed the opinion that Kant's central problem was not at all that of scientific knowledge, but rather the problem of the metaphysical comprehension of being. Kant's philosophy he declared to be a philosophy of finite man, whose access to the infinite is denied, but whose orientation toward the transcendent confirms his very finitude. (Pos, 1949: 67).

Heidegger was not right in his claim that the whole aim of Kantian Critique was to support ontology. On the contrary, it was a philosophical enterprise against metaphysical thought. It was a kind of de-ontologization that refers here in that context that knowledge is possible in the light of reason and within its limits, only not beyond its limits. In other words, de-ontologization was an attempt to free thought from the dogma of the absolute that believes the truth can be attributed to things that transcend reason. De-ontologization is an attempt to eliminate the metaphysical concepts in favour of acceptable concepts which express functional connections between the given.

For The Marburg School, the value of Kant's philosophy comes through the method he used to investigate some issues in philosophy and his aim of finding new answers to them. They regard the *Critique of Pure Reason* and the transcendental deduction in particular as

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the decisive part of Kant's work. They believe that the transcendental perspective is a valid method for discovering the constructive nature of the world.

The Neo Kantians availed themselves of what they called "the transcendental method" in conscious opposition to psychology or empirical methods. Knowledge in order to be truly objective, must rest upon secure foundations that are necessary, universal, and apodictically true. (Pisher, 1988: 9).

Neo-Kantians use the transcendental method to investigate problems implied in Kant either by presenting new solutions to problems in the light of new developments in modern sciences or by applying it to new domains of knowledge. For the Marburg School, the transcendental method became unavoidable for scientific philosophy. They were interested in the question of how we can understand the progress of modern sciences in the light of Kantian principles. In addition they were interested in how the Kantian account is applicable to the domains of ethics and aesthetics experience particularly and experiences related to culture; religion, myth, art and language generally. When they wrote about logic they refer neither to formal logic nor to modern logic but to transcendental logic where it implies a formal function or an intellectual meaning attached to objects. The transcendental logic is used by them to show the active state of reason that can be noticed through all productive achievements of consciousness. As evidence of that we can see clearly how logic had a significant place in their writings.

For example in Cohen's 1902 book *Logik der reinen Erkenntnis*, "Logic of Pure Knowledge", his (1904) *Ethik des reinen Willens* "Ethics of Pure Will" and his (1912) *Asthetik des reinen Gefuthls* "Aesthetics of Pure feeling", he attempted to show the activity of reason and its pure generation of meanings. In addition, there is Natorp's 1910 book, *Del Logischen Grundlagen Der Exacten Wissenschaften*. In Cassirer's 1910 book *Substance and Function* he discussed the different logical perspectives of science and replaced them by functional-relational thought. Although the members of the Marburg School shared the view on the pure activity of reason, there is an epistemological break that occurred between Cassirer and the rest of the Marburg teachings as we shall see later.

There was agreement between them on some issues that characterize their particular style of thought concerning some Kantian notions and also on some other issues derived from

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recent developments in modern sciences. Cassirer's philosophical development was a broad project, since he applies the transcendental method to different kinds of human experience. With that understood, I determine three principal problems that developed through his intellectual development that differentiate him from the Marburg School. These three problems are the problem of scientific concept formation, the problem of the symbolic form of experience and finally the problem of Man. Following that determination, my main concern is to distinguish three main stages in Cassirer's intellectual development that had a significant influence on his thought. These stages are: the Berlin stage from 1900-1923, the Hamburg stage from 1923 –1933, and lastly the emigration stage, from 1933- 1945.

These new developments of Cassirer's philosophical view brought about a significant departure from Cohen, the founder of the Marburg school. Although these three stages are considered to be my framework for discussing Cassirer's intellectual development, I am not going to follow a chronicle order, rather I will trace the developments that took place with to these three mentioned problems by breaking sometimes this chronicle order for the sake of bringing the differences between Cassirer and the Marburg School and then display another issue that may strength on the differences between Cassirer and the Marburg School.

The most significant element characterizing the Berlin period (1900- 1923) is the agreement between Cassirer, Cohen and Natorp. However, by the end of the Berlin period a disagreement had emerged between them. It is first important to show the common philosophical features shared by the Marburg school and Cassirer. The general view of the Marburg School was that true knowledge is grounded in mathematical thought. The apriori elements are the real products not of experience but of pure thought. For instance, Cohen's concept of *generation* is one of these a priori elements. He believed that the concept of generation is a suitable one because it leads one to interpret Kantian works systematically. In his view, science is the best evidence for the fact that reality has been created by us, since we are only capable of knowing that which we have put into things (Zank, 1998: 399 Also Ollig, 1998: 780). The Marburg School agreed that such knowledge is only relevant to the logic of cognition. Therefore, both Natorp and Cassirer extended Cohen's concept of

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generation from the field of exact sciences and applied it to morality, religion and art. This meant that the generative activities of reason extend to include the whole creative work of culture. The Marburg School's aim was to understand objects through a web of relations that can only be organized within a logical system:

The goal of cognition, is the universal and complete determination of the "object" of cognition which leaves nothing undetermined in the original X. The method by means of which alone this can be achieved is, according to Natorp, the method of establishing functional relations which are integrated into a contextual system of experience. Upon such integration depends the very meaning of our term "nature" the possibility of conceiving "nature" as a system of laws or dynamic interrelations. (Werkmeister, 1949: 766).

The Marburg School insisted on the importance of system and they also insisted that knowledge can only be accessible through systematic perspectives constituted by laws. They consider the laws that organize our objects are not mutually independent, but are related to each other in one comprehensive network. We can find an answer here to the question of why the Marburg School confirms the scientific value of systematic thought. The answer seems to be because they seek to achieve the objectivity of knowledge. They aimed to have a systematic discipline where priority will be given to laws over the elements. This process of organization presupposes a unitary origin that explains the relation between the object and the logical determination. In fact that presupposed unitary origin is neither a psychological nor a metaphysical entity whose existence would have to be assumed. It is rather the logical ideal of the whole comprehensive context of experience that arranges the elements of that context. One peculiar aspect of the Marburg School is that they sought to lead thought toward systematic unity. They believe that objects must be constructed through the generic laws of reason. This understanding brings us to a discussion of the concept of reality from the Marburg School's perspective and Cassirer's view of it. According to the Marburg school, the "object" neither means something that exists in itself, nor something that goes beyond us and has an external existence apart from thought. On the contrary, they indicated that an object becomes an element ordered within certain context. It is now a pure possibility of arrangement according to law.

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As in the case of mathematical equations the unknown variables x, y, z have meaning for the equation and within the equation only by virtue of the meaning of the equation itself, i.e., in relation to the “invariables” the assumed “variables” and the “roots” of the equation, just so, and only so, is the great X of cognition, the “object” meaningful and understandable only as an element within the context of cognition.... There is no longer any need for the assumption that “objects” exist in and by themselves. All we need to accept now is the possibility of an orderly progress of cognition, the possibility of establishing an all-comprehensive context according to law, the method of securing scientific cognition. (Werkmeister, 1949: 764-765).

They unify thought and object and argued that thought precedes objects. According to them, it is meaningless to ascribe an independent existence of objects apart from thought and its comprehensive laws. Indeed Natorp explains the relation between object and thought as follows:

For thought, all “being” exists only in and through thought itself. Logically there is nothing prior to thinking. The X of cognition may be determined as an A or a B or a C ; but as X it is only the “pure expression” and not an entity, psychological, metaphysical, or otherwise. (Werkmeister, 1949: 765).

For them the objects are knowable only through the process of logical construction in which we give structure to the manifolds of experience. According to the Marburg School, reality and its objects have to be underlined in the light of structures. As a result, reality can be defined as a permanent creation and a continuous activity of thought through our reason which gives a structure to different aspects of our world.

We can also see the same conception of reality implemented within Cassirer’s writings in the ‘Berlin period’. For instance, in his *Problem of Knowledge* (1906) Cassirer maintains the same meaning of reality which ascribes a creative and genetic activity to thought in which there is no independent existence of objects apart from thought itself (Gawronsky, 1949: 17 & Hmden, 1960: 349). According to Cassirer, reason builds up a new ideal world to discover the unity of the objects. This chapter claims that the general aim of Cassirer’s earlier philosophy was to understand the relation between objects and thought from transcendental idealism. Therefore reality, according to Cassirer, is displayed through thought and is only accessible through the logical determination of thought.

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The entirety of Cassirer's earlier philosophy was designed to show that reality does not somehow exist "outside" of our forms of knowledge, and that any "copy" theory of knowledge is fraught with contradictions. (Moynahan, 1999: 565).

The Marburg School members believed that the object is not given nor is it ready-made and complete in itself. Rather the object, as they comprehend it, is attainable only at the end of the cognitive process, not at its beginning. In contrast to realistic interpretations of reality, Cassirer's view of object and reality, in his Berlin stage, argues that we do not grasp objects by a process of abstraction. Rather, objects are the products of a dynamic and creative process of reason. Objects do not exist prior to and external to the laws of reason, but are constituted through the laws. Our understanding of the world is not a purely passive process but it is a free and constructive activity of the mind.

This idealistic perspective extended to the exact sciences. If the Marburg School account of the origin of object is right, then there are crucial difficulties that Cassirer must face and to which he must find solutions. These difficulties are logical ones, because some of these difficulties came from the traditional understanding of both the formal logic of Aristotle and the empiricists' views regarding the origin of concepts. Another kind of difficulty comes from the challenges that Kantian transcendental philosophy faced in light of the development of the modern sciences. The question now is how the Marburg School and Cassirer could successfully address these difficulties. The answer to the first half of the question lies in the problem of abstraction as Cassirer discussed it. His solution will be discussed fully in the next section on scientific concepts.

According to their idealism, objects are generated by laws. An object is not something discovered, but something created by thought. Despite this fact, in his transcendental deduction Kant claimed that our elementary acts of consciousness of the world involved a combination of both intuitions and concepts. He went further by arguing that prior to that combination, there is no consciousness at all. In contrast, the Marburg School members went beyond Kantian dualism between empirical intuitions and concepts. They rejected the Kantian theory of sensibility and accepted his theory of understanding. They took thought as their starting point and rejected the idea that thought has an origin outside itself in the

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external world. The refutation of the Kantian theory of the dual origin of knowledge (intuition and concepts) led them not only to abandon the transcendental Aesthetics as a doctrine of the sensibility, but also the transcendental Deduction (Malter, 1981: 538-539).

In comparison to Kant, the Marburg School reduced the importance of intuition and at the same time extended the role of understanding in their philosophy. It seems that their reason for going beyond the Kantian notion of empirical intuitions was their comprehension of the development of the exact sciences and developments particularly in the concepts of space and time. The Marburg School established a very important principle: that the activity of thought creates the content of thought. Like Kant, they give an important role to thought within exact science. The ultimate task of reason is to construct a coherent whole, and to give experience a structure and coherence. Therefore Cassirer shares the neo-Kantian view of the priority of laws over objects. When Cassirer was talking about reality and objects, he does not in fact mean any external world separated and completed in itself standing apart from thought. Cassirer supports the claim that reality and objects have to be developed through structural forms that give experience its constructive unity. The reason to reject sensibility is the Marburg School's aim to transcend the passive or negative element implied in the Kantian theory of knowledge.

The second challenge was that Kant built up his view on the assumption that Newtonian science is the ultimate criterion of exact science. But Newtonian physics could not provide modern science with plausible answers to the numerous questions that it raised concerning reality, physical objects and the nature of the microscopic universe. When Kant established his views on space and physics, he depended on the Newtonian mechanical laws. But as exact science progressed further scientists developed other ways of explanation and various philosophical schools rebuilt their views in the light of the new scientific discoveries.

In the Marburg writings the entire a priori structure used to root Newtonianism in a permanent theory of reason, was sheared away. (Itzkoff, 1997: 62-63).

Therefore it was necessary for the Marburg School to go beyond the Kantian conception of science, and to occupy themselves with the more recent problems of the exact sciences. It

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was not unusual to see in their writings discussions of modern scientific issues. For example, in 1907 Cassirer discussed in detail some problems of modern mathematics in his book *Kant Und Die Moderne Mathematik*. In that book, Cassirer discussed the Kantian understanding of mathematics in the light of the logical developments of modern theories of mathematics. In addition, in 1910 Cassirer wrote his *Substance and Function* where he discussed the logical foundations of the exact sciences from a historical and logical point of view. Cassirer claims that the beginning of knowledge must not be from the senses and the a priori forms of sensibility space and time in their simple forms but grounded in mathematical principles. Only such knowledge is relevant for the logic of cognition. This understanding reflects Cassirer's thoughts on physical reality. Cassirer took a distinct turn away from the Marburg School when he explains the spatial and temporal determinations of physical objects.

Cassirer's argument starts from his objection to the Kantian view that states that both space and time are pure forms of intuitions. Kant claimed that any object of which we could be conscious had to be an object in space and time. Kant believed that we are aware of an independently existing world in space and time that is composed of substances interacting causally with each other. The reason for Kant to state that was his understanding of Newton's three laws of motion, which give a specific account of classical mechanics. Following Newton, Kant assumed that the three laws of motion presuppose absolute space and absolute time. Cassirer could make use of the ideas raised in Einstein's general theory of relativity to develop his own account of physical reality. In contrast to Natorp's view of classical mechanics, Cassirer explains physical reality from the perspective of the development of quantum mechanics in his emigration period after 1933. Cassirer explains that there are objects like "uncertainty relations" in quantum mechanics which involve problems that cannot be solved within the framework of classical mechanics. For example, "Fields of forces" are not entities in the classical sense of material or rigid bodies. In addition, the concept of "mass" can no longer be regarded as ponderable reality but must be resolved into electric charges. It was Cassirer who supported the claim that the whole conception of a physical body must be redefined in a way that goes beyond classical mechanics definition of physical body. Therefore, according to Cassirer's comprehension

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of quantum mechanics, the “field” is not a “thing” but it is a “system of effects”. Cassirer contrasts his own position with that of Natorp who defends in his 1910 the idea that “existence” means the complete and absolute determination of an “object” with respect to space and time (Werkmeister, 1949: 774).

The difference between Cassirer and the Marburg School members was that the latter developed their account of physical reality in respect to classical mechanics simply because they did not follow Einstein’s general theory of relativity; this could be because either Cohen passed away 1918, or because Natorp published his 1910 *Die Logischen Grundlagen Der Exacten Wissenschaften* before the publication of Einstein’s general theory. Although Natorp passed away in 1924 we did not find any response from Natorp to Einstein’s general theory of Relativity. But we find Cassirer’s responses to Einstein’s theory in his 1920 article *Philosophische Probleme Der Relativitätstheorie* and his 1921 essay *Zur Einsteinschen Relativitätstheorie*. These two articles formed the background of Cassirer 1923 supplement *Einstein’s Theory of Relativity Considered From the Epistemological Standpoint* that has been added to his *Substance and Function*. Reading Einstein’s theory of Relativity in that stage led Cassirer to develop his own view of physical reality that took him slowly from the Cohen’s and Natorp’s analysis of reality of physical objects.

To sum up, in his Berlin stage Cassirer began to go slowly beyond the Marburg School’s analysis of physical object that they had developed in respect to classical mechanics. Cassirer presented his analysis of physical object in light of new developments in physical theories. In other words, classical mechanics assumed that the state of a “thing” in space could be completely determined at any given moment and in every respect. Such determination became the ground for the definition of “reality” of a thing. Only an object that can be determined completely in space-time was called “real”.

In contrast, Cassirer defends the view that the individuality of an electron can no longer be defined or determined sufficiently to be considered as a thing in space and time. The individuality of an electron, for example, is not something given but only constitutes

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specific points of possible relations with other electrons within a system. Regarding the electron, physical reality is now concerned with the functional dependencies of relations and not concerned with individual things called “electrons”. The development that took place in physics and quantum mechanics led Cassirer to depart the Marburg School's interpretation of science and the understanding given to scientific concepts. Cassirer himself admits that departure in his 1936 *Determinism and Indeterminism in Modern Physics* twenty six years after he published *Substance and Function* was published.

So also the ties which connect me with the founders of the Marburg School are not loosened and my debt of gratitude to them is not diminished when in the following investigations it turns out that the epistemological examination of the principles of science leads me to results different from those set forth in Cohen's *Logik der Reinen Erkenntnis* (1902) or in Natorp's *Die Logischen Grundlagen Der Exakten Wissenschaften* (1910) (Cassirer, 1956: XXIV).

An example of that departure can be traced from Cassirer's view of physics. Cassirer explained that field theories and the uncertainty relations of quantum mechanics cannot be explained in the framework of classical mechanics. He pointed to the concept of “atom” and argued that we cannot go beyond the problems implied in our understanding of new developments unless we ask and decide the question what is the meaning of the reality of atoms. The atom accordingly can no longer be conceived as a thing, but it must be understood as a system of dynamic relations and have to be described only through the laws which express its effects. The same understanding is also applied to the concepts of electrons, orbits and mass. These concepts are no longer things in themselves or pre-exist and given to us before experience but they are determined within the process of cognition. Cassirer in his 1936 pointed out the invalidity of the concept of reality grasped in classical mechanics as supported by Kant's epistemology. Cassirer quoted from Kant's *Kritik der reinen Vernunft* a paragraph that shows how the Kantian interpretation of science based on the fact that reality is given to us through experience and is matched with the empirical laws:

“The objects of experience, then, are *never* given *in themselves*, but only in experience, and have no existence outside it. That there may be inhabitants in the moon, although no one has ever perceived them, must certainly be admitted. This, however, only means that in the possible advance of experience we may encounter them. For every thing is real which stands in connection with a perception in accordance with

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the laws of empirical science if therefore the uncertainty relations shows us that we can no longer hope to “encounter” an electron at a certain point in space with a sharply determined momentum, then the assertion of empirical reality for this state of affairs loses its basis; it has passed out of “the context of experience”. All those peculiar problems that have troubled atomic physics from time to time now automatically disappear. (Cassirer, 1956: 179).

Cassirer found that we have to give up asking questions such as where the individual electron is at a given instant of time, how it is transformed from one state to another state, and why it performs such a transition. All these kinds of questions seem to be inadequate to be asked now (Cassirer, 1956: 179). Cassirer refers again to Natorp’s view that mentioned in his *Die logischen Grundlagen der exakten wissenschaften* to show that it is a mistake to follow Natorp’s analysis of the existence of the object. Natorp declares in his 1910 that view:

Existence has no other meaning for Criticism (Kritizismus) than a thoroughgoing, in no respect incomplete, determinateness of being with respect to space and time. Space and time are the condition of judgment of existence- that is, of the complete determination of objects in experience.... To every point of space,... that is to be given existentially, there must correspond a point or absolute element of what exists, namely each must correspond to an identical point in existence ,i.e., time.

Cassirer did not only criticize Natorp but also criticized Kant and others like Schlick for their explanations of reality. He states:

If one uses these explanations as a basis for objective reality, it will at once be seen what far-reaching changes in our empirical world picture are demanded by quantum mechanics by virtue of the uncertainty relations. For now we can no longer define existence as something completely and thoroughly determined. The “state” of a physical system no longer exhibits, according to the language of quantum theory, the same form of spatiotemporal connection which it possessed in classical mechanics. In the latter, all the individual elements of being could be isolated from each other; each particular entity was, in a given instant of time, referred to a quite definite point of space, and “adhered” to it exclusively. Quantum mechanics, on the other hand, demands that we abandon this conception. (Cassirer, 1956: 190-191).

Cassirer developed his philosophical account to find a place to include these scientific developments within his philosophical interpretations in respect to his Neo-Kantian spirit.

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This spirit understands the “field” not as a “thing”, but as a “system” of effects.

In his Berlin stage another difference between Cassirer and Cohen emerged over the concept of relation. Cassirer understood the concept of relation differently from Cohen. This difference in their interpretations of the concept of relation led Cohen himself to reveal in one of his letters to Cassirer in 1910 that the unity of thought of the Marburg School was broken as a result of Cassirer’s view of relation.

Our Unity was jeopardized. (Cohen, Letter to Cassirer quoted in Gawronsky 1949: 20).

Like Natorp, Cohen was influenced by Newtonian mechanics and he defended the idea of absolute space and time. In 1910 when Cassirer gave a draft of his *Substance and Function* to Cohen to read before publishing it, there was a paragraph in Cassirer’s book that seemed to Cohen to be quite inconsistent with the teachings of the Marburg School. Although all of Cohen’s closest disciples were convinced that Cohen was mistaken, Cassirer decided to re-write the whole page to show his respect to Cohen (Gawronsky, 1949: 21). But the break has to come when Cohen wrote a letter in 1910 to Cassirer to congratulate him on his book and he ended his letter with that significant remark that shows how Cassirer started distinguishing himself from the Marburg School:

Yet, after my first reading of your book I still cannot discard as wrong what I told you in Marburg: you put the center of gravity upon the concept of relation and you believe that you accomplished with the help of this concept of idealization of all materiality. The expression even escaped you, that the concept of relation is a category; yet it is a category only insofar as it is function, and function unavoidably demands the infinitesimal element in which alone the root of the ideal reality can be found. (Cohen, letter to Cassirer quoted in Gawronsky 1949: 21).

Cassirer considered that the infinitesimal is not a thing “Ding” but a condition, not of any sort of reality, but an instrument of thought for the discovery of the construction of true being. It seems clear that Cohen also sought to apply the idea of the absolute in mathematics by arguing that to establish the infinitesimal numbers as an absolute element, to put this absolute element before the whole number and to derive the latter from the former. But Cassirer argued that it is impossible to reach the absolute element because the

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act of enumeration is only directed to finite numbers; from the other side it is impossible to reach the absolute element because the psychological synthesis of the act of enumeration would exclude the actual infinite (Cassirer, 1923: 64-65).

According to Cassirer's general thesis shown in his *Substance and Function* there is no place for absoluteness in our understanding concerning science and its laws. When we bring that understanding to the numbers it shows that it is a mistake to try to connect between infinity and reality as Cohen sought to show when he claimed that the number can be derived from that absolute element and obtain its value from that element. However Cassirer shows that number acquires its value not as being an entity or referring to something that exists, rather number acquires its value from the place it occupies in the series and with its relation to other number. Cassirer explained that numbers acquire their value according to a function that sets up the relationships between numbers in a series. It is an endless process which never implies in itself an absolute element:

For mathematical thought, the fundamental relation, that includes within itself all the members that proceed from it, becomes itself a new element, a kind of fundamental unity, from which a new form of number-construction takes its start. The whole endless totality of natural numbers, in so far as it is "given" by a law," i.e., in so far as it is to be treated as a unity, becomes the starting-point for a new construction. From the first order there arise other and more complex orders, which use the former as material base. (Cassirer, 1923: 66).

It follows from that view that he refuted Cohen's infinitesimal element and replaced Cohen's idea with Felix Klein's idea of "*group*" that presupposes an invariant element that remains unchanged during geometrical transformations. This theme will be explained in Chapter Three. Like the Marburg School members, Cassirer agreed with them on the priority of laws over objects, they along with Cassirer went a step further towards setting up what can be referred to as "logical monism". Then the question is how could Cassirer apply the principle of "logical monism" to his study of scientific concepts? In addition to that, are there some radical changes within Cassirer's system, in the "Hamburg" period that would increase the gap between his view and the Marburg School's teachings?

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To answer these questions, we need first to discuss Cassirer's theory of scientific concept formation.

2-3 Cassirer and the Reconstruction of Scientific Concepts

This section will discuss Cassirer's theory of formation of scientific concepts. Our aim here is to discuss first his criticisms of the theory of abstraction and the theory of representation which have been taken by different philosophers as logical grounds on which they presented their views of forming scientific concepts. Secondly we will address the constructive and positive part of his theory, which includes an original contribution from Cassirer to the understanding of the construction of scientific concepts.

2-3-1 Scientific Concepts and Substantial Thought

Cassirer was concerned with understanding the foundations of the sciences. Therefore, Cassirer paid more attention to substituting the ontological perspective of science with a new epistemological perspective that may help in understanding the new developments in the sciences. He believed that any particular science, including its theories, concepts and laws, has to be understood from the viewpoint of logic. Cassirer presents his systematic work *Substance and Function* in which he discusses the formation of scientific concepts from the logical point of view. It seems clear that Cassirer's aim throughout that work, is to build up a unified method for investigating the structures of exact sciences. Being a philosopher of science, Cassirer's central question was the nature of scientific concepts and the role they play in the structure of science.

Before discussing his theory of scientific concept formation, the main argument presented through his *Substance and Function* that is considered to be the peculiar aspect of his Berlin period will be summarized. Cassirer's argument consists of two parts; a destructive part where he criticizes the Aristotelian and Empiricist's accounts of scientific concepts formation. He refers to these traditional accounts of formation of the concepts by using the

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term “substance”. The constructive part was he replaced the traditional views of the formation of scientific concepts with a constructive procedure and gives it the name of “function”. Cassirer was guided by the idea that the structure and laws of thought could be most clearly displayed in mathematics and physics, where knowledge had reached its highest level. Therefore it will be plausible to express the difference between these two different accounts using the “*concept of thing*” to refer to ontological grounds of the concepts and to use the “*concept of law*” to refer to the functional grounds.

Throughout his argument, Cassirer used the term *Substance* as synonymous with the concept of thing. Cassirer criticized the analyses presented to scientific concepts that based on the substantial thought. The reason to criticize that account was that he found that the main activity of the mind lies in determining and isolating common qualitative elements within the wide variety of existing things and uniting them into classes and repeating this procedure as long as possible. In light of that traditional view, Cassirer found that scientific concepts could be random aggregates of qualities. For example, we do not form a class of yellowish, juicy, edible things under which lemon and mango might be subsumed because such an idea is not relevant for theoretical and practical ends.

The selection of what is common remains an empty play of ideas if it is not assumed that what is thus gained is, at the same time, the real form which guarantees the causal and teleological connection of particular things. The real and ultimate similarities of things are also the creative forces from which they spring and according to which they are formed. The process of comparing things and of grouping them together, according to similar properties, as it is expressed first of all in language, does not lead to what is indefinite, but if rightly conducted, ends in the discovery of the real essence of things.(Cassirer,1923:7).

Cassirer criticized the traditional view of Aristotle and the empiricists concerning the formation of scientific concepts because he found that scientific concepts could not be based on qualitative similarities. He concluded that mental activity no longer depends on recognizing the qualitative similarities or differences and selecting on this basis. Rather, Cassirer argued that mental activity of reason has to occupy itself with another task more complicated than the classification and selection and subsumption under universal concepts.

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Cassirer showed the constructive aspect of his argument by replacing the term “Substance” with term “Relation”. In Relational thought, the mind has an active role to play, that is, to arrange objects in respect to laws or general orders. What we need is a relation to ordering, we do not need to dispose of the qualities of the objects concerned, but rather we replace fixed qualities with general rules, which enable us to grasp a total series of possible qualitative determinations. The main idea that Cassirer is interested in here is that the object does not have independent characteristics, but these characteristics are changeable depending on the rule or order of arrangement, as we shall explain later. Now Cassirer gives examples from the history of science of how scientific concepts shifted from thing-concepts to relation-concepts. He applies this understanding to the concept of law as an example of how the formation of scientific concepts takes place in functional-relational thought:

The concept of law is now regarded as prior to that of object, whereas it used to be subordinate to it. In the substantialistic conception there used to be a definitely determined entity, which bore certain attributes and which entered, with other entities, into definite relations expressible by laws of nature. In the functional view-point, by contrast, this entity constitutes no longer the self-evident starting point but the final goal and end of the consideration: we no longer have absolute, completely determined entities, from which we can immediately read off the laws and to which we can attach them as their attributes .(Cassirer, 1956: 131-132).

Cassirer supported his argument by giving evidence from exact sciences, mathematics and physics, of how thought gradually replaced the concept of thing by the concept of relation. As evidence for his claim, he indicates how thought transmits from Aristotle’s physics to Galileo’s and from Newton’s physics to quantum mechanics. During these developments, a significant change took place in the conceptual framework of science by shifting from substance to function. Cassirer’s purpose was to confirm that the advancement of sciences is marked by a progressive shift from naïve realism that starts from a conception of things in themselves and interprets knowledge as the conformity of our thoughts with those pre-established objects.

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Scientific experience is not a mere aggregate of perception, it has a complex structure which constitutes its unity. Distinguishing between two aspects of Cassirer's argument in his *Substance and Function*, I will discuss now the first part of his argument that I call the destructive aspect in which Cassirer criticizes both dogmatic realism and sensationalism.

The problem of scientific concepts acquires its significance when the philosopher of science involves himself with studying the relation between thought and existence and when he seeks an understanding of reality. In fact the philosopher of science cannot examine that relation without implying certain logical presuppositions that form his own understanding of the nature of concept and judgment. According to that illumination, Cassirer's first step was to show the invalidity of both Aristotle's and the empiricist conception of scientific concepts. The question now is, how did Aristotle present his view of concepts based on his theory of formal logic? In addition, what is the ontological aspect of Aristotle's theory of abstraction on which he based his theory of concepts?

From the critical point of view, the general aim of Aristotle through his writings was the issue of Being. Aristotle's logic was written to maintain a secure path for his metaphysics. Clear evidence of that is his theory of category which aimed to reveal the different aspects of existence. Aristotle gave all his concern to the category of substance over the other categories. Therefore substance can be defined as substrate. There are two alternative meanings of the term "substrate" which could be used in this context. Substrate can be understood as the [carrier of the objects, but substance will not be an object for other predict.]. The other meaning of substrate is the unchangeable element during the continuous changes in objects. Here we will depend on the second meaning to explain Cassirer's view on substantial thought. There is a result can be deduced from this discussion clearly. There is a fixed element supposed in existence and the task of philosophical investigation, according to Aristotle, is to determine that unchangeable element within the process of change. Aristotle's task was to find the proper forms of physical matter. The aim of his logic was to give unity to the diversity or chaos of matter.

In respect to Aristotle's substantialism, we can now analyze, according to Cassirer's account, Aristotle's theory of concepts and reveal its ontological and its substantial aspects.

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Nothing is presupposed save the existence of things in their inexhaustible multiplicity, and the power of the mind to select from this wealth of particular existence those features that are common to several of them. When we thus collect objects characterized by possession of some common property into classes, and when we repeat this process upon higher levels, there gradually arises an ever firmer order and division of being, according to the series of factual similarities running through the particular things....The concept does not appear as something foreign to sensuous reality, but forms a *part* of this reality; it is a selection from what is immediately contained in it. (Cassirer, 1923: 4-5).

To have a concept of an object, we need to define that object by its relation to similar species that have the same characteristics: John, Richard, and Jasmine, for example, can be subsumed under the genus "Mankind". To have a concept, it is necessary to ascend upward towards general and abstract concepts or to descend downward toward the variety of individuals. Generally, a concept can be defined by referring either to its nearest genus or to its nearest species. In other words, concepts can be grasped only through the essential relation, subsumption and subordination of species and genus:

Every series of comparable objects has a supreme generic concept, which comprehends within itself all the determinations in which these objects agree, while on the other hand, within this supreme genus, the sub-species at various levels are defined by properties belonging only to a part of the elements. In the same way a certain characteristic, thereby drawing a larger range of objects into the circle, so by a reverse process, the specification of the genus takes place through the progressive addition of new elements of contents. Hence, if we call the number of properties of a concept the magnitude of its *content*, this magnitude as we descend from the higher concepts to the lower, and thus diminishes the number of species subordinate to the concept; while, when we ascend to the higher genus, this content will diminish as the number of species is increased. (Cassirer, 1923: 5-6).

Here the thought has two functions, firstly to isolate the objects with similar characteristics from the other objects that have different features and secondly to unify and to subsume these similar objects under a certain concept. Therefore the formation of concepts depends on these two cognitive processes; isolation and unification. In this way, the unity of thought is reduced to similar physical objects. Although similar objects can be subsumed under a certain concept, an object does not lose its identity and its individuality. Throughout its development, the concept must come from a circle of Being either in its primary forms as particulars or in its abstracted form. The object does not lose its identity when it is

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subsumed under a general concept. For example John is a man and despite the fact that others share with him the qualities of being a man, he keeps his identity as an independent entity distinct from them. Similarly, we can see the notion of Being is also implemented in the field of science where concepts, as was claimed by Aristotle, are the free creation of thought.

This is the dilemma that was created by Aristotle and grasped by his followers. This dilemma can be summarized as the following: Aristotle and his followers thought that concepts are universal rules of ordering, and these concepts have the capacity to order the particulars because they are created by thought. However, in fact they are just mere generalizations of particular examples and from the similar qualities we generalize them and unify them under certain concepts. The perception of generalization from similar particulars is what Aristotle calls abstraction. For instance, the geometrical figure of a triangle is considered to be a universal concept that subsumes different kinds of triangle; scalene, equilateral, isosceles and right-angled.

It seems that Aristotle's account of the formation of concepts was based on the first law of thought, that is the law of identity that states A will remain A regardless of accidental changes that may take place over A that we discussed it in Chapter One. How does the law of identity provide an explanation for Aristotle's account of concepts?

According to Aristotle, the form is unchanged while the matter ceases to exist. For example a brown table will have the form of table even if we paint it red or blue. A triangle could be broken into small pieces, but the form of triangle will never change but remain unchanged. In these two cases, the matter vanishes, but the form remains unchanged. The same thought is applicable here, the object will remain the same object regardless of the accidental changes. For instance, John will remain John if he wears a jacket or a t-shirt, whether he dyes his hair red or blue he will retain the same identity. Cassirer rejected this version of realism about physical and geometrical objects. He considered that the concept is not apart from sensuous reality but constitutes part of physical and external reality. Therefore Cassirer considered that concept has an identical unity based on a naïve realism that starts

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from a conception of things and an understanding of concepts in light of pre-established objects.

This is the epistemological ground on which Aristotelian logic depended and as was pointed out, metaphysics plays an important role in the formation of his scientific concept. Therefore Cassirer's *Substance and Function* attempts the very complicated task of explaining the defects of earlier views of concept formation. Cassirer critically identifies these defects from the view point of modern logic.

According to Cassirer's view, we do not need to reduce a group of similar objects having common characteristics to a general concept abstracted from an aggregation of similar particulars. On the contrary, the concept should be presupposed and created through the dynamic process of reason before ordering the particulars. Hence Cassirer reverses the priority between individual and concept. In Substantial Thought, the individual comes first and then concepts are general ideas abstracted from similar individuals. Functional-Relational thought, in contrast, comprehends the concept as being a rule constructed and logically precedes individuals themselves.

The concept, however, is not deduced thereby, but presupposed; for, when we ascribe to a manifold an order and connection of elements, we have already presupposed the concept, if not in its complete form, yet in its fundamental function. (Cassirer, 1923: 17).

Another defect of Aristotle's theory of concepts is that it does not guarantee that objects with properties in common, can be subsumed under one general concept because we could have objects with similar properties but it is not reasonable for one general concept to imply them. Here Cassirer uses an example that was used by Lotze to show that the rule, offered by traditional logic, is not adequate in giving an account of the formation of scientific concepts:

The traditional rule, however, for the formation of the generic concept contains in itself no guarantee that this end will be actually achieved. In fact, there is nothing to assure that the common properties, which we select from any arbitrary collection of objects, include the truly typical features, which characterize and determine the total structures of the members of the collection. We may borrow a drastic example from Lotze: if we group cherries and meat together under the attributes red, juicy and edible, we do not

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thereby attain a valid logical concept but a meaningless combination of words, quite useless for the comprehension of the particular cases. (Cassirer, 1923:7).

Although a piece of meat and one piece of cherry have some properties in common such as the colour, state and purpose, we cannot subsume these two objects under one general concept. This example indicates the fact that the formation of any concept requires something else, transcending the similarities and dissimilarities between things.

Being aware of these epistemological defects in Aristotle's logic, Cassirer found that the Aristotelian account of concept formation is not reliable. As a result, Cassirer investigates the Empiricist's view as it had been represented by G. Berkeley, D. Hume and J.S Mill.

The empiricist's account represents part of Cassirer's destructive argument against the traditional view. In fact Cassirer paid scant attention to the psychological account, another attempt to form the concepts of the sciences. The main reason for this was Cassirer's belief that the formal and empiricist views are two sides of the same coin. Cassirer claims that the ontological themes included within formal logic could also be applied to the psychological perspective of forming concepts. For an empiricist, the existence that he investigates is the inner existence of consciousness depending on psychological laws; resemblance, causality, and contiguity of stimulations. Thus the whole process of scientific concept formation is now transformed into the realm of presentations:

In fact, in the psychological deduction of the concept, the traditional schema is not so much changed as carried over to another field. While formerly it had been outer things that were compared and out of which a common element was selected, here the same process is merely transformed to presentations as psychical correlates of things. The process is only, as it were, removed to another dimension, in that it is taken out of the field of the physical into that of the psychical, while its general course and structure remain the same. (Cassirer, 1923:10-11).

The empiricist, according to Cassirer, aims to establish knowledge of the world with reference to sensations. Therefore, the question for him is how we construct concepts through what is given through experience. The world for him is a group of impressions or, more accurately, a group of representative images derived as copies of objects. It is a specific realm of ideas and images, "past" "memory" and "present" sensations", which is

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constantly contended in an endless flux of experiences. The supreme function of the mind, in this view, is to copy, classify and represent external objects under general names. In respect of the function of mind, according to the psychological account of the empiricist, sensations have an important role in the empiricist account of concepts. Although sensations are detached from external objects, they still have an existential power that impacts on our thought. The existential power of sensation can be defined as the influence of external objects on our sensations regardless of whether this influence is strong or weak. In brief, images, memory or sensations still remain subliminally present and are ready to be called up by some stimulus. The mutual co-operation between sensation and thought is the unique feature of empiricist thought. The logical system of Mill gives a clear example as he relies particularly on psychology and its principles for one side and, more generally on empiricism from another.

We claim that the whole goal of the psychological empiricism of Mill was to reveal how the activity of thought builds up our knowledge from our sensations. Throughout the *System of Logic Ratiocinative and Inductive*, Mill sought to give an account of how mind acquires knowledge. One of these issues discussed in his *System* was the concept of reality. The reality that Mill refers to here is that of the phenomena as states of external or internal consciousness as considered the subject of logic (Mill, vol.2: 139-140).

Being an empiricist, Mill considered that the concepts are merely copies of certain factual properties of the given reality of things as we produce them in representations. Mill was loyal to that belief; the importance of existence in our epistemology and it will be clearly shown in his formation of scientific concepts.

The points, lines, circles, and squares which any one has in his mind, are (I apprehend) simply copies of the points, lines, circles, and squares which he has known in his experience. Our idea of a point I apprehend to be simply our idea of the *minimum visible* the smallest portion of surface which we can see. A line as defined by geometers is wholly inconceivable. We can reason about a line as if it had no breadth; because we of all the control we can exercise over power, when a perception is present to our senses or a conception to our intellects, of attending to a part only of that perception or a conception instead of the whole. But we cannot *conceive* a line without breadth ; we can form no mental picture of such a line; all the lines which we have in our minds are lines possessing breadth. If any one doubts this, we may refer him to his own experience. (Mill, 1884: 148).

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The clear example of that assumption can be derived from his view on the concept of number. Mill understands number not as a mere member in a numerical series with its essence drawn in its relative position in that series. On the contrary, Mill understands number with respect to the arrangements of things in reality as we experience them. For instance, the proposition $2+3=5$ does not describe mere numbers that have specific relative relation in a numerical series. Rather, it describes an experience, which has been forced upon us by the process of joining things together. For example, when we put one billiard-ball to another, we add names of things which could be two balls or two pens and so on. Mill considered this addition they are not names of certain objects, rather they are names of a certain process. Every number must therefore point out to physical phenomena and refers to physical properties of those phenomena. Mill indicates that comprehension of the function of number in his system of logic when he says:

When we call a collection of objects two, three or four, they are not two, three, or four in the abstract; they are two, three, or four things of some particular kind; Pebbles, horses, inches, pounds weight. What the name of number connotes is, a manner in which single objects of the given kind must be put together, in order to produce that particular aggregate. If the aggregate be of pebbles, and we call it two, the name implies that, to compose the aggregate, one pebble must be joined to one pebble. (Mill, 1967: 91-92).

This comprehension leads to the claim that all arithmetical operations, like addition, subtraction, division and multiplication depend on physical objects. Our mind understands the calculus systems as mere statements concerning groups of presentations. It is experience that provides us with the general base of arithmetic and geometry. For example, a “round square” is not a valid concept because experience shows us that a thing loses the property of having four corners the moment it assumes the property of roundness. Therefore the beginning of one impression is inseparably connected with the cessation of the other (Cassirer, 1923:13). Mill’s system of logic was an attempt to substitute the concrete for the abstract, and the realm of material entities for the realm of mathematical signs. Therefore I disagree with the claim which has been raised by Brain in his comments on Mill’s book *Analysis of The Phenomena Of The Human Mind* numbers, as they had been understood by Mill, are not names of objects. Rather, they are names of a certain process

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like addition (See Brain, 1869: 91). On the contrary, Cassirer believed that Mill's view of formation of the concept of number refers to things not only operations as claimed by Brain. Cassirer's view was that Mill formed his concept of number in respect of objects only and their reflections on our mind. For example we cannot understand the number one as an operation but we understand it as a reference to any specific object such as a book, disk or door. This understanding leads to the conclusion that reality was the fundamental reference upon which Mill constructed his logic and his theory of scientific concepts. It seems to me that Vector Brochard was right when he claimed that Mill's logic is a logical system which deals with things. All images and sensations are the effects of direct contact with external things. (Brochard, 1954: 388).

It is now important to point out that the psychological perspective of forming concepts depends on what called "psychological abstraction". This concept aims to group the objects under a common name or more specifically subordinate similar objects under a general concept. This remark has been mentioned by Cassirer when he refers to the similarity between objects as the core problem of psychological perspective of concept formation.

2-3-2 Cassirer and the Functional-Relational thought

Being a historian of the philosophy of science, Cassirer's primary interest was to trace the movement of modern scientific revolutions in the field of exact and biological sciences like arithmetic, geometry, physics and biology. He paid attention to the common factor that explains and justifies the advancement of these sciences. He seeks to find the logical structures that paved the way for these revolutions to take place in modern sciences and to transcend the substantial thought. Here we will discuss the constructive part of Cassirer's argument based on functional-relational thought rather than substantial thought as an alternative to form scientific concepts. Cassirer replaced substance with relation and reinterpreted the notion of relation. Cassirer confirms that such a relation does not dispose of the qualities of the individual objects concerned. Cassirer tries to show that "thing-concept" was replaced with "relation-concept" and the latter gradually used to explain the developments took places in sciences.

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Here Cassirer not only confirms the role of relation over the concept of substance, but also gives the concept of relation another meaning completely different from that of Aristotle. For Aristotle, relation is a category formulated to meet his metaphysical doctrine and is developed not to be independent of the existence of the particulars. In contrast, Cassirer provides a new account in which the concept of relation is devoted to dispose the possible relationships of relata and their places in the system. It is a new account that concerns with the relationship between the whole and its parts, not the relationship between thing and its characteristics. According to Cassirer, relation is an order of arrangement that brings systematic order to the particulars within a form. The idea of relation, according to Cassirer, departed from the ontological thought to enter logical and functional thought.

The category of relation especially is forced into a dependent and subordinate by this fundamental metaphysical doctrine of Aristotle. Relation is not independent of the concept of real being; it can only add supplementary and real external modifications to the latter, such as do not affect its real "nature". In this way the Aristotelian doctrine of the formation of the concept came to have a characteristic feature, which has remained in spite of all the manifold transformations it has undergone. The fundamental categorical relation of the thing to its properties remains henceforth the guiding point of view; while relational determinations are only considered in so far as they can be transformed, by some sort of mediation, into properties of a subject or of a plurality of subjects. This view is in evidence in the textbooks of formal logic in that relations or connections, as a rule, are considered among the "non-essential" properties of a concept.... Here a methodological distinction of great significance appears. The two chief forms of logic, which are especially apposed to each other in the modern scientific development, are distinguished-as will become clear-by the different value which is placed upon *thing-concepts* and *relation-concept*. (Cassirer, 1923: 8).

The concept of relation determines the relation between a particular and a general rule where the elements of any group would be organized and ordered in respect to a certain rule. In fact Cassirer uses various terms when he refers to the relation between the universal rule and the elements of any given object. He sometimes expresses that relation in terms of form and its contents; the context and its element; and finally, in a mathematical fashion, as a relation between an invariant and its variables. In all these different terms, the universal can be understood as a rule that generates possible connections between particulars and orders them under a general formula. Cassirer claims that the function of the organizational

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rule is to unify the members under a higher form of logical synthesis. Therefore the object is only comprehensible as an element of the structure or a member in the series:

Context, as here understood, must mean and imply the preservation of the logical significance of each individual element and, at the same time, the unification of elements in a higher logical unity.... The particulars must be preserved within the context, and the context must be maintained despite all the differentiations. (Werkmeister, 1949: 764).

It seems clear that the importance of Cassirer's notion of structure or the system comes from the Kantian idea of schematism, which states that to have a mind is not to be made of any kind of particulars, but rather, is to be able to perform certain kinds of activities that involve rules. Even calculations of mathematics and geometry, although founded in the pure intuitions of space and time, themselves require schemata. A schema is thus just a rule or a set of rules that specifies how to construct a concept and therefore a judgment. The logical forms of judgment actually become the categories of experience only when they are rendered into temporalized form or what Kant calls their "schema" which mean nothing except they provide us with the rules to construct them in terms of how they actually apply to experience. Cassirer in his *Kants Leben und Lehre* of 1918 refers to Kant's view of constructing concepts. He mentioned Kant as an example of how the relationship between the universal and the particular is formed:

Geometrical construction is "prior" to the individual geometrical form, because the meaning of the individual form is established only via the construction, not the other way around- the meaning of the construction through the individual form. All the necessity belonging to geometrical judgments rests on this fact. In geometry the cases do not exist apart from the law, as things detached and independent; they basically issue from consciousness of the law. In geometry the particular does not constitute the presupposition of the universal; rather it is thought only by means of determining and specifying more exactly the universal in general. In this sense geometry and arithmetic furnish the immediate confirmation of a principle that Kant now puts forward as the universal norm and the touchstone of the "new method of thought" "namely", that we can know a priori of things only what we ourselves put into them. (Cassirer, 1918 trans. 1981: 157-158).

I strongly believe that Cassirer made use of that idea not only to form his view concerning scientific concepts but also to construct his whole philosophical system, specifically what

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he calls “the philosophy of symbolic forms” as we will see later. The importance of Kantian schematism was that it paved the way for Cassirer to understand the relation between universal and particular through the different activities of human thought. He claims that every particular presupposes a structure or a system that gives it its features. The question that should be asked now is what role does the idea of structure perform in Cassirer’s theory of scientific concepts?

The answer to that question depends entirely on the following presupposition that the unity of our thought must arise not from objects, but instead from the structure or function that gives the objects their characteristics. Cassirer believes that cognition of objects can only be gained through the structure that arranges and relates them under certain law. Cassirer makes use of modern mathematics to form his epistemological view. Thus with Cassirer, the mathematical doctrine of relations found its way into critical philosophy. In mathematics we depend on our analysis of mathematical facts that shows that there is an ideal meaning that is not derived from any sense datum. The task of mathematics is not to describe the chaos of the realm of sense. Rather it is to describe mere relational structures. For example, every function has an ideal meaning or relation is prior to the objects they relate.

There is no doubting the great influence of mathematics on Cassirer in leading him to his account of scientific concepts. I think there are two reasons why Cassirer uses mathematical understanding to form his theory of concepts. Firstly he wants to give scientific concepts an accurate language derived from mathematical terms, like function, invariance, transformationetc and these terms provide a precise language. Secondly mathematical language does not refer to any physical entities, rather it refers to possible values that members of any set or class acquire. Using the mathematical language and understanding its modern developments helped Cassirer to develop his view of the formation of scientific concepts.

Cassirer considers number as a concept that does not refer to these two states, but refers only to the pure possibility of arrangement and order of the members of a set.

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In truth, however, the connection of the members of a series by the possession of a common “property” is only a special example of logically possible connections in general. The connection of the members is in every case produced by some general *law of arrangement* through which a thoroughgoing rule of succession is established. That which binds the elements of the series $a, b, c \dots$ together is not itself a new element, that was factually blended with them, but it is the rule of progression, which remains the same, no matter in which member it is represented. The function $F(a, b), F(b, c), \dots$, which determines the sort of dependence between the successive members, is obviously not to be pointed out as itself a member of the series, which exists and develops according to it. . . . The concept, however, is not deduced thereby, but presupposed; for when we ascribe to a manifold an order and connection of elements, we have already presupposed the concept, if in its complete form yet in its fundamental function. (Cassirer, 1923: 17).

Cassirer confirms the idea that our understanding has to overcome all mathematical theories that explain number depending on the substantial thought or more specifically on the logic of the generic concept:

Thus the conflict of mathematical theories here again combines with the general questions of logical principle that were our starting-point. In the different interpretations of the concept of number, there is repeated the general conflict between the logic of the generic concept and the logic of the relational concept. (Cassirer, 1923: 53).

It is not necessary to build up a concept to refer to any given or representative object. The functional-relational thought transcends the ontological aspect of the formation of concepts and is only concerned with the relational aspect where the values ascribed to the members are gained from the relative place in the cognitive structure.

Now we are going to discuss another aspect of scientific concepts: “objectivity”. Objectivity means nothing more than that the objects that form the core meaning of the concept are dissolved into a web of relations that are comprehensible in light of certain orders or laws. Objectivity, according to Cassirer, refers to the priority of laws over the chaos of things. Scientific concepts are no longer copies or representations of impressions of substantial objects of the external world. We will discuss the objectivity of concepts when we refer to perception. The importance of Cassirer’s project toward composing a theory of scientific concepts was his intellectual ability to apply mathematical understanding of the theory of relations to the physical world. It seems the real reason for

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Cassirer to do that task was in order to reveal the objective nature of concepts by implementing that functional method to different exact sciences. Clear evidence of that claim can be captured in his *Substance and Function* when he submitted physics to the functional-relational perspective.

The field of application of this form of logic is not confined to mathematics alone. On the contrary, it extends over into the field of the knowledge of nature; for the concept of function constitutes the general schema and model according to which the modern concept of nature has been modeled in its progressive historical development.(Cassirer, 1923: 21).

Applying the functional thought to physical sciences, will lead us to interpret the origin of essence not as the external objects but as structure itself. Cassirer's way of understanding physical nature was to reveal the constructive system of nature itself, and to show physical objects are constructed in the light of these intellectual systems (Hamburg, 1949: 85-91). Reality and its objects are only attainable through pure conditions and structures provided by thought. The physical object now no longer refers to an independent entity in itself but to a web of relations organized in respect to invariant factors that remain unchanged during physical transformations, as we shall explain in the next chapter (Cassirer, 1923: 273).

The aim of empirical knowledge in Cassirer's view is to identify constructive elements that remain constant in contrast to the changing elements of experience. Again here Cassirer follows his general philosophical view while he analyzes the concept of nature. What remain invariant during physical change are structures themselves. Cassirer's concern was to identify the possible structures that can be ascribed to the object. Physical reality is attainable now as a reality of relative and possible constructions or forms, rather than of independent entities. (Ryckman, 1999: 600-601).

Science advanced greatly when it comprehended scientific concepts not as attached to the reality of things, but as a free construction of possible relations. Thought creates structures under which individuals are ordered. These logical structures are permanent structures but permanence here has nothing to do with any ontological claim regarding the permanence of the external objects because misunderstanding Cassirer's meaning of permanence would

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bring us back into the circle of metaphysics. The permanence ascribed to the structures here has to be understood logically in the sense that structures will remain unchanged when there are no changes in the conditions that determine them (Ferretti, 1989:101-103). In that sense permanent structure, according to Cassirer, is synonymous with the mathematical term invariance where both of these concepts refer to the fact that the structure will remain unchanged when the conditions determining either physical experience or a mathematical series are unchanged.

The force and conclusiveness of geometrical proof always rests then in the invariants of the system, not in what is peculiar to the individual members as such. It is this interpretation, which Poncelet characterizes philosophically by the expression principle of continuity, and which he formulates more precisely as the principle of the permanence of mathematical relations. The only postulate that is involved can be formulated by saying that it is possible to maintain the validity of certain relations, defined once for all, in spite of a change in the content of the particular terms, i.e., of the particular relata. (Cassirer, 1923:80-81).

Cassirer put that comparison between what is empirically constant and what is logically constant when he differentiated between empirical cognition and logical knowledge.

The constancy of the ideal forms has no longer a purely static, but also and especially a dynamic meaning; it is not so much constantly in *being*, as rather constancy in *logical* use. (Cassirer, 1923:323).

When Cassirer replaces ontological permanence by mathematical permanence, he indeed develops what it calls “logical monism”. Logical monism means that the entire physical reality and its contents are determined by laws. The objects of knowledge are grasped and developed only in the light of the dynamic process of thought, where the activities of thought are devoted to building up structures and disciplines to arrange and order the contents of the objects or the members of mathematical series.

Therefore Cassirer, by adapting logical monism in his study of scientific concepts, agrees with the teachings of the Marburg School. Cassirer, like the Marburg School members, is concerned with the logical unity of the structure. Structure has to be understood, according to Cassirer, as the preservation of the logical significance of each individual element and, at the same time, the unification of elements in a higher logical unity. Logical monism simply

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means that nothing transcends the laws of thought. There is no longer any need for the assumption that objects exist in and by themselves. All that is required is the possibility of establishing an all-comprehensive context according to law, and the method of securing scientific cognition. That sense of logical monism shows the deep belief of Cassirer and the rest of the Marburg School that the unity of context does significantly mean the unity of thought itself. Yet Cassirer distinguishes himself from their teachings by extending and applying logical monism to new fields. If we consider Cassirer's writings in his Hamburg period (1923-1933) we can observe that Cassirer's thought began to be directed toward some areas of research that had never been discussed by the Marburg School.

During the Hamburg period (1923-1933) Cassirer aimed to find constructive functions in various aspects of culture. As a result, he presented to the philosophical community in sequence in 1923, the first part of his *Philosophie Der Symolischen Formen* or *The Philosophy of Symbolic Forms* where he addressed the development of language from a historical point of view. Cassirer seeks to apply his theory of scientific concept formation to language. According to Cassirer, a word might in primitive languages initially be used to refer to an external object; however through the development of language, words are now implying a meaning that signifies a symbol instead of referring to a particular thing. The same thought is also applied to his second part of *Philosophie Der Symolischen Formen* (1925), as an attempt to discover the realm of myths. In fact the second part of his philosophy of symbolic forms is a major work whose primary seeds can be found in his *Zur Philosophie Der Mythologie* (1924) in which he discusses the development of mythical thought and its relation to religion. The main reason for Cassirer to study these different topics was to transcend the univocal perspective of the Marburg School. Cassirer strongly believed that the goal of reason is not to understand just the exact sciences but all of reality. That is why he extended his philosophical enterprise to cultural realms. Taking forward that understanding will open a new horizon to trace the functional thought as applied to different realms of culture. Now the question that should be asked is; what epistemic roles do symbolic forms perform in experience?

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2-4 Cassirer and the Symbolic Forms of Experience

This section will discuss the main philosophical ideas developed by Cassirer during his Hamburg period (1923-1933) and see how far these philosophical ideas separated him from the Marburg School. In addition, it will be argued that Cassirer's concern shifted from the realm of exact sciences to develop a philosophy of Man that we call the anthropology of Man where man lives in a constructive world of meanings and symbols.

2-4-1 The symbolic Construction of experience

According to Cassirer, the fundamental principle of critical thought is that the function precedes the object. Cassirer's aim in his earlier philosophical view was to reveal the functional or constructive nature of scientific concepts. In his Hamburg period, Cassirer extends his philosophical project to examine the validity of that principle in different epistemological contexts. Therefore, Cassirer's central argument was to show that cultural forms including language, myth, and art have the same functional nature as scientific concepts. The main role that function has to play in the realms of culture is to unify and organize our experiences, and this role is only performable through the structures of reason. In respect to that understanding, we find ourselves in front of a unique attempt to unify our theoretical view of the world. The problem of knowledge is no longer concerned just with scientific theories but includes also a comprehensive view of the world. The question now is, how successfully did Cassirer achieve that project? The answer lies in his central concept of the "symbolic form" that he raised in 1923. What is the importance of the "symbolic form" and what is the specific role it plays in his philological enterprise?

According to Cassirer, a form, considered as a logical structure, includes a rule for arranging its contents and elements. As indicated before, any thing might be said to have a form that follows a pattern that exhibits order and internal connections. Cassirer's *Substance and Function* and *Philosophy of Symbolic Forms* aimed to analyze human experience in its broad sense and to separate two moments implied in experience the

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sensuous and constructive meaning. Cassirer's aim through his series of symbolic forms was to discover the constructive meanings that are immanently implied in cultural objects which bring unity and coherence to the cultural objects. Cassirer ascribed three constructive meaning to arrange the different realm of culture, these meanings are; expression, intuition and concept.

These constructive meanings are functions that order our chaotic experience concerning the objects of nature as we will discuss in the next chapter. The symbolic forms are dynamic moments of thought by which an intelligible content of meaning is attached to a concrete, sensory sign (Koris, 1999: 540).

The symbolic form has to be grasped through physical objects, but at the same time it has to transcend physical objects to capture that ideal or constructive meaning by which we organize our experience about physical objects. For example, if we contemplate nature and its scenes, it may seem that it is a group of detached scenes with no connection. In this case, the physical objects could not be transcended. But those people who could find constructive meanings or orders that can organize all these scenes, will find design and systematic unity in nature itself.

Cassirer's central concern was to find the real relationship between man and his world and to reveal the secret of reality from Man himself and his instruments of thought. Cassirer understood reality as categorized internally in Man's spirit. The supreme aim in his later philosophy was to examine the productions of human spirit. It is difficult to imagine any form of reality independently of such symbolic forms.

When Cassirer extends his philosophical project, he no longer talks about scientific reality but focuses instead on spiritual reality. Two reasons can be presented now to justify that epistemological shift. The first reason was to examine the whole validity of his theory of concepts by applying it to another domain drastically different from exact science. The second reason was that Cassirer wished to establish a new science of spirit, which I call morphology of human spirit, a science that studies different forms of culture as a pure production of spirit. The reason I call it the morphology of spirit is Cassirer's definition of Man as "symbolizing animal". Cassirer believed that what gives Man its unique statue is

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his ability to create symbols and give the concrete various meanings which are pure activities of spirit. Bidney, D in his 1949 article “*On the Philosophical Anthropology of Ernest Cassirer and its Relation to the History of Anthropological Thought*” claimed that Cassirer’s aim when he started his *Philosophy of Symbolic Forms* was stress the autonomous creativity of the spirit and envisage spirit as a function and energy of construction. He claimed that the whole thesis of symbolic forms was an attempt to demonstrate that the whole of human culture is understood as an historical expression of the human spirit. He quoted a paragraph from Cassirer to defend his claim:

It tries to understand and demonstrate how all the content of culture-in so far as it is more than merely singular content, in so far as it is grounded in a universal formal principle-presumes an original act of spirit(Geist). It is in this that the basic tenet of idealism finds its specific and completer validation.

(Cassirer, 1953, quoted from Bidney,1949: 500).

The originality of Cassirer’s attempt lies in his belief that the symbolic form is an instrument for human kind to construct his world that distinguishes him from all other creations. The process of creation forms considered to be as a spontaneous and a progressive process where our consciousness continuously provides us with constructive forms to organize the flow of impressions. Cassirer could, in his Hamburg period, develop and import symbolic forms for the intelligibility of reality. Cassirer’s aim, in agreement with the Marburg School members, was to explore the structural forms implied in the sensible world. Apart from applying his logical monism to different forms of reality, and adopting new perspectives raised in the General theory of Relativity concerning space and time, Cassirer shares the epistemic view of the Marburg School.

2-4-2 The Philosophy of Man and Symbolic Pregnancy

In this section I will discuss the third and the last period of Cassirer’s philosophical development: the period of emigration (1933-1945). In this period Cassirer visited and worked in different countries; England, Sweden and United States of America, particularly

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after Hitler persecuted the Jews in Germany after 1933. In the emigration period, Cassirer resumed his philosophical enterprise begun in Hamburg period. Cassirer published in this period *Determinism and Indeterminism in Modern Physics* in 1936 as an application of his Functional-Relational thought to quantum mechanics. He also wrote the fourth volume of *The Problem of Knowledge* in 1941 but published later after he passed away, where he discussed the recent development of science. In the emigration period Cassirer became a structuralist in his philosophical analyses and he applied his structuralism to three different fields; in 1938 he published his article in French “*Le Concept de Groupe et la Theorie de la Perception*” translated in 1944 as “*The Concept of Group and the Theory of Perception*” where he applied his understanding of group theory to perception aiming to set up what he called “the invariant theory of experience”.

The second application was to the worlds of Man, Cassirer sought to show how Man could construct the different domains of civilization and unify them as he expressed that view in his *An Essay on Man* 1944. The third application of his structuralism was to the language in his 1942 article “*The Influence of Language upon the Development of Scientific Thought*” and his 1946 article “*Structuralism in Modern Linguistics*”. There are some recent studies that interpret Cassirer's works in the light of structuralism, such as Ihmig (1999), Ryckman (1999) and French (1999). Structuralism is a philosophical perspective that pays attention to the structure or the form confirming its importance over the content or the matter. For example French, Ihmig and Ryckman set up their arguments on the later developments of Cassirer's scientific view as developed in his *Einstein's Theory of Relativity* and his 1936 *Determinism and Indeterminism in Modern Physics*. For example, according to Ihmig, Cassirer is a structuralist because Cassirer understands the unity of objects to depend on the unity of law not the unity of simple elements. Ihmig, in his reading to Cassirer, explains that the unity of the concept of object, from the structuralist perspective, is reinstated on a higher level through lawful unity. He indicates that the process of abstraction from a substantivalist conception of objects to a structuralist one is furthered by the General Theory of Relativity and what is left is an understanding of the objects of a theory as defined by Lorentz transformations that leave the relevant physical magnitudes invariant. Thus Cassirer saw General Relativity as the natural conclusion of the structuralist tendency.

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Both Ryckman and French's arguments depend on Cassirer's *Determinism and Indeterminism*, which gave Cassirer's interpretation of quantum mechanics:

We are concerned not so much with the existence of things as with the objective validity of relations; and all our knowledge of atoms can be led back to, and depends on, this validity. (Cassirer, 1956:143).

In classical mechanics in contrast, objectivity rests on spatio-temporal persistence of the objects. In quantum physics we cannot say that the particles possess definite properties at all times, even beyond measurement interactions, or that they travel along well-defined trajectories. French cites two questions raised by Cassirer in support the view that Cassirer was a structuralist:

'... what **are** these electrons whose path we can no longer follow? Is there any sense in ascribing to them a definite, strictly determined existence, which, however, is only incompletely accessible to us? (Cassirer, 1956: 178).

French based his interpretation of Cassirer as a structuralist on these two questions. Namely that we take the 'conditions of accessibility' as conditions of the objects of experience (French, 1999: 2-3). From the structuralist view, the entity constitutes no longer the self-evident starting point but the final goal and end of the consideration (French, 1999: 4-5).

Cassirer's structuralism went to the extent that all the phenomena and all observable, apparently separate elements are understood only when seen as positions in a structure or system of relations. Cassirer's version of structuralism shares the other versions of structuralism raised by Piaget, Chomsky, Foucault and Althusser. All of them agreed that the elements of the object have to be understood within a system. For them, language is like social and cultural phenomena are not physical objects and events but objects and events with meaning.

According to that interpretation, the original division between the intelligible and the sensuous vanishes. We still remain in a world of images but these are not images that reproduce a self-subsistent world of "things"; they are whole image-worlds whose principle and origin are to be formed in an autonomous creation of the spirit. Through them alone we see what we call "reality" and in them alone we possess it. For the highest objective truth

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that is accessible to the spirit is ultimately the form of its own activity in all this the human spirit, according to Cassirer, now perceives itself and reality. Cassirer confirms these structural or ideal meanings that enable us to grasp reality.

The same meaning has been confirmed by Cassirer in 1953 where the importance has been given to ideal meanings not to existence:

It is here that we pass beyond passive receptivity to an indeterminate outward material, and begin to place upon it our independent imprint which articulates it for us into diverse spheres and forms of reality. Myth and art, language and science, are in this sense configurations towards being: they are not simple copies of an existing reality but represent the main directions of the spiritual movement, of the ideal process by which reality is constituted for us as one and many –as a diversity of forms which are ultimately held together by a unity of meaning. (Cassirer, 1953: 107).

For Cassirer, each one of these forms builds up its own intelligible realm of intrinsic meaning. The symbolic forms conceive reality as a real process of embodying relations, not as a fixed order of things. For Cassirer, the real concern of symbolic forms is not to raise questions about the existence of objects and what they *are* but to raise questions concerning the possible ways we construct them under universal forms. Cassirer's structural realism can also be noticed through his concept "*Symbolic Pregnancy*" discussed in the third volume of *Philosophy of Symbolic Forms* that found another application in Cassirer 1944 *An Essay On Man*. The question that has to be raised now is how the external object acquires a symbolic meaning. The answer to this question lies in Cassirer's term "symbolic pregnancy". He indicated a sensible object implies a meaning which gives it its unity:

By symbolic pregnancy we mean the way in which a perception as a sensory experience contains at the same time a certain nonintuitive meaning which it immediately and concretely represents. Here we are not dealing with bare perceptive data, on which some sort of apperceptive acts are later grafted, through which they are interpreted, judged, transformed. Rather, it is the perception itself which by virtue of its own immanent organization, takes on a kind of spiritual articulation-which, being ordered in itself, also belonging to a determinate order of meaning. In its full actuality, its living totality, it is at the same time a life "in" meaning. It is not only subsequently received into this sphere but is, one might say, born into it. It is this ideal interwovenness, this relatedness of the total single perceptive phenomenon, given here and now, to a characteristic total meaning that the term "pregnancy" is meant to designate. (Cassirer, 1957: 202).

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The symbolic meaning provides objects with their completeness and unity. For Cassirer, the creative activity of mind lies in its ability to discover constructive meanings in the world we perceive. Cassirer was keen to show that the world and its objects in different domains of civilization can be understood as the product of the creative activity of thought. This is the *holistic structuralism* of Cassirer as we shall explain in the following chapters.

This structuralism also applied to perception. Cassirer aimed to set up an account of perception based on that version of structuralism by applying the functional-relational approach to the facts of perception. Cassirer argued that objects as we perceive them are a matter of internal organization of thought.

For Cassirer, the theory of perception has no other role than to transform the chaos of particulars into a system and a coherent form submitted to laws. In his 1944 *The Concept of Group and the Theory of Perception*” Cassirer achieved that goal by applying group theory to the perceptual world and explaining the new order of the arrangement of the elements. Cassirer aimed to show the constructive nature of perception by claiming that there is a non-intuitive element implied in perception that gives it constructive unity. In addition, Cassirer explained that perceived objects do not have independent and hence fixed characteristics but the objects can be transformed and hence phenomenologically represented differently in respect to different orders of arrangement.

This conclusion led Cassirer to argue that the modern theory of perception has to be understood under the concept of transformation and invariance as we shall explain in the next chapters. Setting up a theory of perception on that understanding led Cassirer to discuss the objectivity of perception. The value of objectivity as he applies it to perception returns to his earlier view of the Berlin period when he stressed the fact that the flux of what are given in experience needs a rule or a principle to connect and organize them.

The objects of experience depend on a complex of universal concepts that Kant calls concepts of pure understanding or categories. When applied to a given manifold, a category is nothing other than a rule of connection that has to be added to perception “in order to grant it the value of ‘objectivity’”. (Cassirer,

1907: Trans in Ihmig, 1999: 520).

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The rules, the structures, and symbols are Cassirer's keys for understanding the constructive world. Man achieves his essence only when he creates symbols and uses them to build up his constructive world. The question now is how could Man constitute his own world? The answer will be given in the following pages.

2-4-3 Cassirer and Philosophy of Man

The most remarkable aspect of Cassirer's philosophical development in the emigration period was his aim of setting up a new philosophy of Man. If we look at his last writings, Cassirer's concern was to address the following issues; what is the nature of Man? the development of the symbol from animal reaction to man responses? and a definition of man in the light of the achievements that have been created by man through times and civilizations. Cassirer took all the productions achieved by man to be as a sign of the richness of his spirit and a mark of his creative power. Cassirer's main concern in the emigration period was to investigate the problem of the dependence of relational thought upon symbolic thought.

Cassirer's philosophy of Man was an attempt to bridge between Berlin and Hamburg stages. After discussing the logical structures of scientific theories and the structural aspects of culture realms he went further by aiming to establish anthropology of man. Cassirer confirmed that man in his creations is no longer dependent upon concrete sense data. Rather man responds to the structures of arrangement. Cassirer gave Helen Keller as an example of man being not dependent on the material things, rather relations and how we construct forms:

The case of Helen Keller, who reached a very high degree of mental development and intellectual culture, shows us clearly and irrefutably that a human being in the construction of his human world is not dependent upon the quality of his sense material. If the theories of sensationalism were right, if every idea were nothing but a faint copy of an original sense impression, then the condition of a blind, deaf, and dumb child would indeed be desperate. For it would be deprived of the very sources of human knowledge; it would be, as it were, an exile from reality. But if we study Helen Keller's autobiography we are at once aware that this is untrue, and at the same time we understand why it is untrue. Human

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culture derives its specific character and its intellectual and moral values, not from the material of which it consists, but from its form, its architectural structure. And this form may be expressed in any sense material.(Cassirer, 1944: 35-36).

Cassirer argued that man developed his reality in the light of these symbolic forms. Thus he claims that these symbols should form the essential principles for a theory of man:

The principle of symbolism, with its universality, validity, and general applicability, is a magic word, the Open Sesame! giving access to the specifically human world, to the world of human culture. Once man is in possession of this magic key further progress is assured. (Cassirer, 1944: 35).

For Cassirer forms are an artificial medium that mediates between human beings and the physical world. In respect to that creative and dynamic activity, Cassirer defines Man as a symbolic animal:

Reason is a very inadequate term with which to comprehend the forms of man's cultural life in all their richness and variety.... Hence, instead of defining man as an animal rationale, we should define him as an animal symbolicum.(Cassirer, 1944: 26).

It seems that the main reason for Cassirer to define man as a symbolic animal was to show the dynamic nature of his spirit in building up his constructive universe in its variety and to reflect the enrichment of his spirit. Man in his path toward civilization, transcended the sensible signs as the sole source of knowledge and concerned with the ideal forms ascribing to sensible signs or objects. The problem that Man had to face, during his intellectual development was, how to find universal meanings implied in the particulars, and how to give explanation to the objects not as independent entities but as outcome of constructive process.

Cassirer believed that symbolic form was a successful effort and that man had to reach his completeness as a symbolic animal who creates symbols and forms the contents of the universal in respect to his structures or ideal ideas as Cassirer sometimes calls them

Without symbolism the life of man would be like that of the prisoners in the cave of Plato's famous simile. Man's life would be confined within the limits of his biological needs and his practical interests; it

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could find no access to the “ideal world” which is opened to him from different sides by religion, art, philosophy, science. (Cassirer, 1944: 41).

It seems that Cassirer wanted to claim that Man, during his intellectual development, was suffering from what I call “epistemological alienation”. He did not state this directly but if we follow his view on the development of the mind of Man, then we could find justification for my claim. In his 1944 Cassirer went through his discussion to the problem of man to show the moments where man was epistemologically alienated. For example, when he analyzed the nature of Man as discussed in Greek philosophy. It considered that the true nature of man can be grasped if we removed from his being all external and incidental characteristics. In that case, man was taken apart from his accidental features that have to be taken into consideration when we try to present a view about man nature. Again Cassirer follows the issue of man and how he was alienated by the time of Christianity. According to Cassirer’s view man was alienated because reason could not show him the way to clarity, to truth and wisdom. Also when the time of Copernicus man also was no longer the center of the universe, however man has placed in an infinite space in which his being seems to be a single and vanishing point (Cassirer, 1944: 8-15).

Cassirer records these moments when man was detached from his universe and its facts either by confirming that truth is in an eternal world, or is there in experience alone, or it is immanent in his feeling and faith. For Cassirer, all these moments are unable to restore man back from his alienation, but it is the historical moment where there was integration between sensuous and symbolic. Man could variously represent the material in the light of different forms. In this moment when the contents of experience formed through constructive meanings, man is no longer alienated. This clue led me to define epistemological alienation as follows:

The consciousness moment when the spirit is captured by the belief that there is something that remains isolated and cannot reach a level where the spirit can recognize it. It is when the object remains unseen until spirit gives it a meaning. This apprehension is what distinguished primitive Man, whose mind worked under the substantial thought, where he

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considered that both symbol and thing refer to the same object. It took thousands of years for Man to transcend that particular moment of consciousness to realize there is a difference between the symbol and the thing. At this historical moment of consciousness, Man could restore his freedom to construct his own universe not in respect of the limited *given* but in respect of the richness of constructive meanings created by thought.

Man's outstanding characteristic, his distinguishing mark, is not his metaphysical or physical nature- but his work. It is this work, it is the system of human activities, which defines and determines the circle of "humanity". Language, myth, religion, art, science, history are the constituents, the various sectors of this circle. A "Philosophy of man" would therefore be a philosophy which would give us insight into the fundamental structure of each of these human activities, and which at the same time would enable us to understand them as an organic whole. Language, art, myth, religion are no isolated, random creations. They are held together by a common bond. But this bond is not *a vinculum substantiale*, as it was conceived and described in scholastic thought; it is rather *a vinculum functionale*. (Cassirer, 1944: 68).

Cassirer's aim to establish a philosophy of Man was to show that Man recognises himself through his intellectual and form- creating process that takes him away from the flux of life:

Man can do no more than to build up his own universe- a symbolic universe that enables him to understand and interpret, to articulate and organize, to synthesize and universalize his human experience. (Cassirer, 1954: 221)

Lets us discuss how Cassirer made use of this philosophical understanding to apply it to perception. This concern will be our main concern in the next chapter.

Cassirer and Gestalt toward a New Account of Perception

3-1 Introduction

The main concern of this chapter is to analyze Cassirer's view on perception and the developments took place in his theory of perception. Our main claim here is to show that Cassirer's account of perception was developed through three stages. The first stage was perception as presented in (1923) where perception was an application of Functional-Relational thought. The second stage was perception as an application of Philosophy of Symbolic Forms (1923 - 1929). And finally, perception is as an application of group theory (1944). In these three stages, Cassirer presented his view of perception in respect to the main issue occupied his thought in each stage. In these three stages, Cassirer used different terms to point out to the constant element that makes perceptual judgment is possible. This constant element presupposed in every perceptual experience and Cassirer used it chronically in (1910) he used "function", "Non-intuitional meaning" in (1923-1929) and finally "invariant" in (1944). These terms are various but imply the same function and are were consistently related to each other.

3-2 Cassirer's Two Accounts of Perception

We are going here to discuss two different accounts discussed by Cassirer, symbolic and logical accounts. We will begin with the symbolic explanation of perception as discussed in *Philosophy of Symbolic Forms*. Then we will discuss the logical account later. But I would like to begin with that assumption that, the attempt to understand these two accounts return back to the orders of the mind and its ability to organize and to unify the chaotic elements of perceptual experience. Therefore we can see that the assumption based on the idea that our reason constructs its objects in respect to structural meanings. Cassirer confirms the structural synthesis that takes place in our cognitive processes. As a result, what I mean by structural synthesis is a synonym to Cassirer's own expression "creative process". In Cassirer's words he says:

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We seek not a unity of effects but a unity of action, not a unity of products but a unity of the creative process. (Cassirer, 1944: 70).

What Cassirer calls creative unity, as we will see later, is nothing more than a dynamic process of the mind to construct perceptual experience and fits its elements into new forms. Cassirer also ascribes this dynamic process and its function to the symbol- concept. I will try to show that perception is considered, along with myth, language and science, a step through it, the mind seeks to give them symbolic meanings and hence brings unity to these disciplines. According to Cassirer, there are three basic meanings and functions, by them mind can construct its realms. These three meanings are the follows; expression, representation and significance and their functions are; “expressive” function (*Ausdrucksfunktion*) for the realm of myth and the arts, "representative" function or “intuitional” function (*Darstellungsfunktion*) for the realms of language and perception, and "conceptual" function (*Bedeutungsfunktion*) for the realm of science and pure thought. We must pay attention to all these functions in which we have the respective worlds of myth, art, common sense and science. Let us discuss Cassirer’s view on perception from the perspective of symbolic philosophy.

3-2-1 Cassirer and the Symbolic Account of Perception

To grasp a significant understanding of the symbolic account of perception, it is better to mention the various different meanings of “symbolic form” or “meaning” as used by Cassirer. Cassirer uses the term “symbol” in three ways. He uses “symbol” to refer to the ideal meaning that organizes the particulars in the experience. Secondly, to refer to the various worlds of culture that includes myth, art, religion, language, common sense and science. Thirdly, he uses “symbol” to refer to space, time, cause and number as particular scientific concepts. Although these three meanings have implications within Cassirer’s philosophical system, I find myself obliged to set aside all these explanations and adopt a different meaning which I hope will help in explaining Cassirer’s views. The symbolic

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form is a rule or a principle which indicates the inner and organic connections between the particulars that it represents and at the same time the constitutive law which organizes the relationships among them and gives them a unitary form. This meaning can be seen in Cassirer in his *Philosophy of Symbolic Forms* where he says:

The symbol contains nothing but the principle of the forms it represents, the constitutive law of their structure, the genetic essence of their formations. It thus refers, not to the similarity of the forms, but to their inner connective law, which may or may not express itself in similarities of form.(Cassirer, 1955: 88).

The reason to confirm that meaning was its logical use where we can apply it to the chaotic world of experience to find out the structural aspect of perceptual experience. I claim that the meaning of form as presented here is important because it bridges Cassirer's two accounts of perception discussed in 1923-1929 and 1944. Because that meaning of form used here implies the same application as it is shown in Cassirer's account of 1944.

It is necessary to ask what is the relationship between "self" and "world"? It seems by raising that question that we open a door to examine metaphysical claims regarding that issue, however we will limit ourselves not to go beyond the circle of epistemology. We argue that the philosophy of symbolic forms does not intend to set up an account of the essence and the properties of the external objects. Instead it seeks to find out all possible connections between the self and experience. It aims to trace the constructive aspects of objects and the way these objects are formed.

Therefore we should discuss three modalities or senses that form our consciousness of the realms of culture. Cassirer insists, throughout his analysis presented in 1953 *Philosophy of Symbolic Forms* volume one, that any object perceived, can always be distinguished from three different types of modalities; ways of perceiving objects, which are "expression, intuition and concept". In other words any object perceived must be determined and comprehended in the light of these three modal forms. For example,

- 1- If the perceived object is determined by the emotive interests of men, it will make an "expressive sense" of the object "sensation".

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- 2- If the perceived object is determined by the teleological interests of men, it will make “intuitional” or “thing-perceptual sense” “perception”.
- 3- If the perceived object is determined by the theoretical interests of men, it will make “conceptual or scientific sense”.

These three modalities are moments of the consciousness which are not randomly added to our consciousness but are three basic moments required for consciousness. These moments are hierarchically arranged. Therefore our reason, to grasp knowledge about the external objects we perceive, had to pass through those three moments. According to that pyramidal order of consciousness, the first moment cannot ascend to the second moment unless we change or adopt different perspective or modality, as we will explain. This simply means that the second moment of our consciousness includes the first moment and correspondingly the last moment includes both the first and the second moments. I mean that the conceptual moment includes both the expressive and intuitional moments. Therefore, according to Cassirer, the end point of the reason to reach how the symbolic experience is constituted under:

From the sphere of sensation to that of perception, from perception to conceptual thinking, and from that again to logical judgement there leads, for critical epistemology, one steady road. Each later moment comprises the earlier, each earlier prepares the later. All the elements constituting cognition refer both to themselves and the “object”. Sensation, perception, are in germ already comprehension, judgement and conclusion. (Cassirer, 1955: 274 from Hartman, 1949: 313).

Let us discuss one of the important concepts used by Cassirer in his view of perception based on his analysis of symbolic forms.

3-2-2 Perception and the Notion of Symbolic Pregnancy

The idea of symbolic pregnancy has a role to play in Cassirer's philosophical system and his account of perception as developed in the light of philosophy of symbolic forms. I claim that Cassirer uses the idea of “*symbolischer Pragnanz*” to emphasis the structural aspect of his philosophy as discussed in Chapter Two. Cassirer used that idea to confirm that perceived objects include structural meanings in respect of which we can form the sensuous

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elements and give them an structural order. In every experience what makes the given reasonable is the ideal meaning that provides the elements of experience with their unity and coherence. Cassirer uses the term ideal meaning to point out also to the orders that presupposed in every perceptual experience. Any act of perception involves meaning or rule by which we develop our comprehension of the parts of experience and give them their unity.

Cassirer's view of perception involves a symbolic character by which any perceived object is not only considered as pure sense datum, but is also a symbol which stands for meanings and references that themselves are not objects of sensuous experience. Here Cassirer sought to explain that in any perceptual experience there are two elements that are implied; sensuous elements and non-physical element that is presupposed and given a priori to experience. For Cassirer, our perceptions include two aspects, a constant or static aspect, that is the content of the perception and a dynamic aspect that is the form. In every perceptual experience that content remains constant, but it is the form that is flexible and dynamic. The form has the capacity to reform the content of experience and arranges its elements differently. Every time the form changes, the content of experience acquires new meaning; that meaning is generated with the form itself.

An example is that sometimes we perceive the object as a form and sometimes as a background depending on the meaning in which we construct the object perceived, as it was explained by the Gestalt psychology as we will discuss in the next chapter. In other words, in perception the elements of any perceptual experience do not have independent characteristics, but these elements can rearranged in different forms and acquire new meanings. In every perceptual experience we ascribe a structure to the perceived object, new meaning is being born within that structure, and that meaning is the function which gives the object its constructive unity. Therefore we can notice that in every object we perceive these two elements; sensuous and ideal meaning, are two conditions for the possibility of experience. The problem between particular and the universal is not only discussed within exact science but also discussed within the symbolic forms of culture.

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Cassirer's main theme was that in every realm of culture there is a constructive activity that aims to bring unity and order to those realms by supposing comprehensive meanings. Cassirer was trying to represent his view of perception using these terms and understanding as he applied them to forms of Culture forms. He was concerned to explain that in perception, we are no longer concerned with properties as things unchanged, but rather it is the meanings that form our view of perception. As we shall soon notice every perceived object includes meaning, by virtue of which, its properties will be ordered and arranged under that meaning. To make it easier for the sake of understanding, I will discuss the problem of language as a model of how Cassirer applies his understanding to language which explains how this account can be applied also to perception. The reason for me to choose language lies in the fact that both language and common sense, according to Cassirer, share the intuitional modality of our thought:

And yet, fundamentally, language as such does not reach beyond the sphere of intuition. It singles out and fixates certain basic factors in intuition, but it does not transcend them. To be sure, "red" or "blue" no longer possesses any correlate directly corresponding to it in the world of sensory impression; nevertheless, there are infinite number of color impressions which concretely fulfill the meaning of red and blue, which can be disclosed as special "cases" of what the universal name signifies.

(Cassirer, 1957: 427).

In Chapter VI from his third volume of philosophy of symbolic forms Cassirer argues that acquired different meanings during its development. In every stage of the development of language, language acquires an ideal meaning that determines its functions and the roles it plays during this stage. Language is important for perception because what we perceive is usually represented by language. He argued that the method of language proceeds from the whole of meaning, as gestalt, to the sentences and words as elements- the parts being understood through the whole. (Cassirer, 1955: 119). Let us begin with this question, what is the symbolic aspect of language? Whether or not it possible, in the realm of language, to conceive the sensory material aspect apart and distinct from the formal or structural aspect?

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Language has its significance and importance in our consciousness because it is an instrument and a means for exchanging thoughts, feelings and desires. Moreover, it is also the first step to recognize the world outside us. Language is used among us in our daily dialogue. It is also used as an important instrument for different sciences to express their facts, concepts and laws. I mean that, language has two standards of understanding; language as an instrument for other sciences and language as a conception in itself dealing with its own problems and concepts. Therefore Cassirer argues that language can be divided into three levels of understanding. This comprehension led him a step forward toward establishing a critical view of the real function of language, dealing with these three levels of development. For him “the function of language is not to copy reality but to symbolize it”. I mean that language in its development no longer refers to things but it uses symbols to refer to objects.

In its first stage of development, language was used to refer to particular thing in reality where every particular thing has its own word that distinguishes it from other things and the only function of language in this early stage was to distinguishing things from each other by ascribing to each thing a certain word. But in the later development of language, the structure and the function of language changed where its task is now not to point to the things of the reality, but rather to symbolize them and signify them by using signs and symbols even though we do not directly perceive the thing or it ceases to be perceived but it still has a sign distinguishing it from other things. Language has shifted from the realm of things to that of meanings as we shall see that language in its development developed from copy to symbol (Cassirer, 1955: 132 quoted from Urban, 1949: 416). According to Cassirer, language has gone through three stages of development:

In general, language can be shown to have passed through three stages in maturing to its specific form, in achieving its inner freedom. In calling these mimetic, the analogical, and the truly symbolical stage, we are for the present merely setting up an abstract schema-but this schema will take a concrete content when we see that it represents a functional law of linguistic growth, which has its specific and characteristic counterpart in other fields such as art and cognition. (Cassirer, 1953: 190).

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1- The first stage or level is a copy or mimetic level where the word is used to refer to a particular thing. When I use a word I point out to that particular thing and then I refer to that particular thing I use a particular word for that. At this primitive stage consciousness unifies the word and the thing, where there is no difference in use between a word and the thing. At this level of development the modality of expression expresses the mythical and religious thought as expressed by language. At this stage, the role of language was to represent the mythical beliefs and religious rituals. Therefore language was an instrument to pointing out to these primitive beliefs based on things and their holy spirits.

Myth and language are inseparable and mutually condition each other. Word and name magic are, like image, an integral part of the magical world view. But in all this the basic presupposition is that word and name do not merely have a function of describing or portraying but contain within them the object and its real powers. Word and name do not designate and signify, they are and act. In the mere sensuous matter of language, in the mere sound of the human voice, there resides a peculiar power over things. Primitive people “exorcise” threatening events and catastrophe, seek to avert eclipses, storms, etc. by song and loud outcry and noise-making. But the mythical- magical power of language is truly manifested in articulated sound. The formed word is itself restricted and individual: each word governs a specific realm of being, over which it may be said to exert unlimited and sovereign power. And it is the most of all the proper name that is bound by mysterious ties to the individuality of an *essence*. (Cassirer, 1955: 40).

2- The second stage is the sensuous or analogical stage in which a separation takes place between words or verbal signs and the things to which they refer. Sometimes Cassirer calls this stage the imitation stage. In this stage, language still uses words to refer to objects, however it is not necessary that the word used will refer to an immediate object, but in this stage, a word can represent an object without need to its actual and immediate presence. Like in abstracted word, like a lion for example, we do not need its real presence to know what it is, but it is just sufficient to use a word lion to represent the object. In the mimetic stage, to get scared it is not sufficient to use the word lion only but you need the immediate presence of the lion. But in the analogical stage, you can only utter the word lion in front of a baby to get scared. The difference between these two levels of understanding language is that both of these two levels presuppose a meaning that organizes our perceptual experience

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differently. Cassirer confirms that in the imitation stage, language although went beyond the direct presence of objects, but still did not go beyond the limits of things:

In imitation the I remains a prisoner of outward impression, excluding all spontaneity of its own, the more fully the aim of imitation has been realized. The richest and most highly differentiated sign languages, those of the primitive peoples, show the strongest bond with outward impression. Along with the immediately impression sensuous, imitative signs, the sign languages of civilized peoples tend to include an abundance of so-called “symbolic gestures,” which do not directly mimic the object or activity to be expressed, but designate it only indirectly. However, such language- for example that of the Cistercian monks or the Neapolitan sign language described in detail by Jorio are obviously not primitive forms but highly complex constructions strongly influenced by the spoken language. But as we go back to the true and independent content of the sign language, mere “concept signs” seem to give way to “things signs”. (Cassirer, 1955: 182).

3- The third stage is the symbolic stage where our consciousness grasps and creates a meaning to the words. In this stage language reaches its peak of development when it can find out the relations between linguistic contexts and give them meaning by virtue of which we can symbolize our reality not just copy it as a mere datum of things and sensations. According to Cassirer, consciousness transcends what is given in experience, it no longer needs the real existence of things but uses symbols and ideal meanings to refer to them. This creates the objective aspect of language where the main concern of our consciousness is not to use words referring to things or entities and their substantial attributes, but rather to construct a system of relations and meanings that provide language with its richness. Having this symbolic meaning, which is the ultimate target for all cultural realms, language reaches its final stage of development. In this stage language is a part of the objective world or spiritual world as Cassirer sometimes calls it in his *Philosophy of Symbolic Forms*. As when science uses pure concepts to express its facts. All scientific concepts use the ideal or symbolic meanings not to refer to an individual but to refer to a relation. Like the concept of number it does not refer to a particular thing or it does not refer to a group of things having similar quantities but rather it refers to a relation that a member occupies in a numerical series where its value differs in respect of the order of the series.

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All these phenomena, to which we might easily add others of like nature, make it evident that even where language starts as purely imitative or “analogical” expression, it constantly strives to extend and finally to surpass its limits. It makes a virtue of necessity, that is, of the ambiguity inevitable in the linguistic sign. For this very ambiguity will not permit the sign to remain a mere individual sign; it compels the spirit to take the decisive step from the concrete function of designation” to the universal and universally valid function of signification.” In this function language casts off, as it were, the sensuous covering in which it has hitherto appeared: mimetic or analogical expression gives way to purely symbolic expression which precisely in and by virtue of its otherness, becomes the vehicle of a new and deeper spiritual content. (Cassirer, 1955: 197).

These three stages and levels of meanings are not distinct. Rather they are logically connected to each other in one chain. Every symbolic function includes within it the three meanings of expression, intuition and symbol. This understanding led us to an answer of the earlier question that the sensuous moment is inseparable from structure moment but the latter is generated and to be given to the former. It is important now to discuss another example that shows Cassirer’s view on perception as he raised it in his *Philosophy of Symbolic Forms*. Our aim will be reveal the constructive aspect of perception in Cassirer’s view of symbolic forms. Therefore our reference point to understand perception will be established on the claim that our consciousness is always presenting meanings which are considered references to sensuous elements in respect of these references perceived objects is constructed. Now I will choose the concept of space and see how Cassirer thought about it from his symbolic account.

3-2-3 Perceptual Space and Symbolic Function

According to Cassirer, space presupposes the same levels implied in language in the sense that both space and language develop from a primitive stage of consciousness upward to the symbolic stage. Therefore we can see that space derives its way to consciousness from the mythical stage where the primitive people used their body organs to refer to spatial determinations. In this stage, every spatial determination depended on the things existing in

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the world and the individuals bodies. For Cassirer, the primitive mind and its mode of space experience can be grasped from the language, rituals and arts they created. The primitive mind developed the experience of space from his way of living and his own rituals. Therefore, there was an unavoidable relation between spatial determinations and the bodily signs as Cassirer indicated when he discussed the emotive-expressive space. One can use his hands to refer to space. For example, if he opens his hands widely, then he refers to a big and wide space. From that understanding of how man can use his body to refer to spatial determination, Cassirer studied the simple forms of space that were produced by the primitive mind. He showed how spatial determinations are based on the organs of the body.

For Cassirer, bodily organs were the reference point to the primitive people which form their experience of space. Cassirer showed how our prepositional concepts concerning space based on the parts of human body. He tried to give example from different cultures that prove that determination of space based on emotive and expressive function. He indicated that in the primitive mind there is tied relation between his language and his view of space because both emerged from the existence of physical things as they are in themselves:

The mandingan languages express our prepositional concepts in "a very material way": behind is expressed by an independent substantive meaning "back" or "rear end," "in front of" by a word meaning "eye," while "on" is designated by "neck" and "in" by "belly," etc. African languages and in the South Sea languages, such words as "face" and "back" "head" and "mouth" "lion" and "hip" perform the same function. (Cassirer, 1953: 207).

Cassirer shows the similar levels of construction between language and space in their emotive-expressive mode and how in this early stage of their development they depended on the parts of human body as a means to allow man to construct his language system and his experience of spatial determinations. Cassirer investigated the issue of how ritual thought of primitive people led them to space experience. According to the primitive mind, spatial determination such as right, left, above and below imply mythical values and mythical significance. There are different classifications of the world depending on the

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ritual and religious belief of the primitive mind. Cassirer indicated when he discussed the religious belief of totems and how the spatial determinations are drawn in the light of totemism:

In the mythical-sociological world view of the Zunis, for example, which Cushing has described in detail, the sevenfold form of the totemic organization, which runs through the whole world, is particularly reflected in the conception of space. Space as a whole is divided into seven zones, north and south, east and west, the upper and the lower world, and finally the center of the world; and every reality occupies its unequivocal position, its definitely prescribed place, within this general classification. The elements of nature, the physical substances as well as the separate phases of the world process, are differentiated accordingly. To the north belongs the air, to the south fire, to the east earth, to the west water; the north is the home of winter, the south of summer, the east of autumn, the west of spring; etc. and the various human classes, occupations, and institutions enter into the same basic schema: war and warriors belong to the north, the hunt and the hunter to the west, medicine and agriculture to the south, magic and religion to the east. (Cassirer, 1955: 88-87).

According to Cassirer, the mythical world view starts from the sphere of sensuous-spatial existence. Cassirer explained that the mythical consciousness of space implies an idea of whole or universal scheme in the light of it, the primitive mind organizes the world in the image and organization of human body. The objective world becomes intelligible to the mythical consciousness and hence divides the world into determinate spheres of existence when only it is analogically copied” in terms of human body. Cassirer gives an example to show not only the objective world but also the whole cosmology was shaped in respect to the human body:

The world *is* the Purusha, for it arose when the gods offered him up as a sacrifice and brought forth the various creatures from the parts of his body, which was dismembered in accordance with the laws of sacrifice. Thus the parts of the world are nothing other than the organs of the human body. The Brahmin was his mouth, his arms were made the Rajanya (warrior), his two thighs the Vaisya (trader and agriculturist), from his feet the Sudra (servile Class) was born. The moon was born from his spirit (manas), from his eye was born the sun, from his mouth Indra and Agni, from his breath Vayu (wind) was born. (Cassirer, 1955: 90-91).

Mythical thinking, regarding cosmic space, is based on the view that there is an unbreakable relation between what a thing is and the place in which it is situated. For

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primitive mind place is itself a part of the thing's being. Space and all its determinations are grounded in a primary identity of nature and its objects. To sum up, mythical space can be grasped from that relation between man and his physical and organic parts of his body. In mythical space there is no distinction between position and content. With the differences between mythical space from one side and perceptual and geometrical space, magical space started from the fact that space is experienced as being on the level of an emotive-expressively experienced world.

The question now, how our consciousness can go beyond the mythical aspect of space and resume its trip to reach to the second stage of space development that is called the intuitional space or perceptual space.

Space of sense perception occupies a kind of middle position between mythical space and space of pure cognition that is geometry. It is clear that space of perception does not match with space of pure mathematics and the determinations of mathematical space do not follow simply from those of sensory space. Space of sense perception involves, as Cassirer claims, the intuitional level of symbolic representation. Cassirer explained the intuitional mode of the space of sense perception in the third volume of his *Philosophy of Symbolic Forms*. Cassirer's main theme was that in perception, we do not perceive things as something permanent, but as changing images depending on the condition of perception. In perception, things lose their sensuous contents and become just signs. In other words, as Cassirer explains, the phenomenon that we perceive loses its independence and self-sufficiency and its individual concretion as soon it functions as a sign for a thing. Similar to the linguistic sign, we no longer are concerned with its tone or its sound, however, we are more concerned with the meaning we capture. We do not experience things in space as they immediately give themselves to us but place themselves in certain contexts through which they gain their characteristics. The space of sense perception is considered to be as the framework in which things have to be realized as an acquisition rather than given. This only can take place when a representative value is attributed to our perception. It is not the matter of representing all the objects as independent entities, but it is a selective process by which one object is selected to represent the same similar objects. Cassirer refers to

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William James's view on the idea of selection as an essential condition for the development of the idea of space. Cassirer quotes James's *The Principle of Psychology* to stress the point of selection:

We have native and fixed optical space-sensations; but experience leads us to select certain ones from among them to be the exclusive bearers of reality: the rest become mere signs and suggesters of these. (James, 1890: 237 Quoted from Cassirer, 1957:155).

Cassirer was convinced with James's idea of selection as a way of determining the objects without needing their physical presence, and Cassirer added to that view that in perception what gives perceptual experience its significance not the immediate presence of the things, but rather the structures that make experience plausible. It is the signs that give perceptual experience its importance not the immediate objects.

In all our perceptions such a selection takes place: in all of them we pick out certain formations which, we say, represent the real form of the object, while we regard others as only peripheral or more or less accidental manifestations of this object. The shifts and distortions of perspective which the image of an object undergoes under certain conditions of vision are in this way corrected. The seeing of an image thus always comprises a definite evaluation of it: we do not see it as it immediately gives itself to us but place it in the context of the total spatial experience and thus give it its characteristic meaning. (Cassirer, 1957: 155-156).

Space of sense perception is about these ideal or symbolic meanings that we gain when we perceive spatial objects. The works of the Gestaltists have given much attention to that issue. Cassirer considered their works as confirming his view that all the various of spatial determinations of depth, distance, form, size and position as they take place on the most immediate level of perceptual experience turn out as conditioned by the signs they give. they are as representative functions of the sort which characterize all other forms of symbolization. Cassirer went further by claiming that the meanings that we grasp when we perceive an object in space depend on the perspective in respect of which we perceive the object. When the perspective is changed or transformed a new meaning will be ascribed to the object and gives it its own characterization. Cassirer discussed different experiments regarding the transformations that take place when we perceive an object in spatial

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experience. Cassirer presented Hornbostel's experiments on perceptual space as will be explained in Chapter Six. Cassirer indicated that if we perceive an object in space and some changes take place regarding the conditions of perceptual experience, then new representations of the same object will be perceived due to the changes happened in our perceptual perspective. In his *Philosophy of Symbolic Forms*, Cassirer argues that the new structure in which the perceived object has been re-formed implies function as representing the parts of the object. The perceived object is not a mere impression but a function as representation, it is no longer given in a passive way, but it is symbolically constructed. (Cassirer, 1957:156).

Cassirer later discussed the idea of invariance as implied in both the pure space of geometry and the intuitional space of sense perception. It is not the concern of things as they are in real and their independent characteristics, rather the apparent things as we perceive them in spatial experience under certain conditions. Therefore, the different perspectives which one use to represent an object in space, will allow us to represent sensory objects by ascribing different spatial properties on the intuitional level of symbolization. Cassirer admits that there is a difference between the space of sense perception and the space of abstract geometrical space. However, these two spaces have a common factor that is a definite mode and direction of constant-formation. Cassirer was influenced by Klein and his view of geometry as we shall discuss in the next chapter. Both perceptual space and geometrical space presuppose an invariant element that remains unchanged if the functions or the conditions determine them are not changed. Therefore Cassirer presupposed that the space of sense experience is like geometrical space in that it implies an invariant factor that remains unchanged during the transformations taking place due to the changes in the situation. When these kinds of changes happen, the objects we perceive in space acquire an intuitive meaning:

For this space, too, comes into being only when a multiplicity of phenomena, of particular optical images, are composed into groups and these groups are taken as representations of one and the same object. From this moment on the changing phenomena only form a periphery; and every part of this periphery sends out points, as it were, which guide our sight in a definite direction, which lead it back over and over again

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to the same thing as a center. And here too- though not to the same extent as in the building of purely geometrical, symbolic space- it is possible to situate these centers differently. The point of reference itself can be shifted; the mode of relation can be changed; and whenever such a change takes place, the phenomenon takes on not only a different abstract signification but also a different concrete-intuitive meaning. (Cassirer, 1957: 157-158).

The various spatial forms as they occur on the most immediate level of perceptual experience turn out to be signs or representative functions of the kind that characterize all other forms of symbolization.

To sum up, Cassirer argued that the space of sense-perception has to be realized as a constructive process of transformation under certain invariants rather than a given. It comes about when a representative value is attributed to our perceptions. When we perceive an object in the space of sense-perception, it can be perceived variously in respect to the point of reference we choose and around it the spatial orientation may proceed. Every point of reference has a meaning that is attributed to the spatial form we perceive and is changeable given a different point of reference. Let us now discuss in brief the symbolic representation of the pure and conceptual space of geometry.

Cassirer also argued that pure geometrical space implies an ideal or symbolic form that characterizes it. In geometrical space we construct space theoretically on axiomatic rules, where space can be constructed variously depending on the geometrical system we adjust. Geometrical space can be constructed either in two or three dimensions, also it can be constructed using Euclidean or non-Euclidean geometry. In the light of pure theoretical space, it seems that pure thought reached its peak by having its characteristic function that takes it away from magic and sensory space. Although geometrical systems formulate possible orders by which the actual may be ordered, the decision is left to experience to decide in which possible order the actual will be submitted.

The concepts of space, time and number furnish the actual structural elements of objective experience as they build themselves up in language. But they can fulfil this task only because, according to their total structure, they keep it an ideal medium, precisely because while they keep to the form of sensuous

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experience, they progressively fill the sensuous with ideal content and make it the symbol of the spiritual. (Cassirer, 1955: 208 quoted from Urban, 1949: 418).

Cassirer used the theoretical framework of geometrical knowledge to support his claim about the ideal meanings implied in experience. To that extent we can see the connection between Substance and Function from one side and the Philosophy of Symbolic Forms as a general way to investigate the structural aspects of experience from another side. Cassirer sought in these two enterprises a way to show how perception is understandable from a structural perspective. Both Substance and Function and Philosophy of Symbolic Forms confirmed that it is the function that logically precedes the elements and group them and also it is the symbol that precedes the given and provides it with meaning. Confirming the structuralism of perception is a genuine contribution of Cassirer's epistemological enterprise.

In his *Philosophy of Symbolic Forms*, Cassirer's aim was to identify the symbolic meanings that represent the different aspects of cultural worlds. The type of this representation as we have seen may be of an immediate nature as in the case of the expressive-magical space of myth. It may be of an intuitional -practical nature, as in the case of the natural world view. Or finally, it may be of a rule determined nature as in geometrical space. Let us now discuss the second account of Cassirer on perception and examine his structural view on perception as he applied it to perception.

3-3 Cassirer and the Logical Account of Perception

We will try here to give an account of Cassirer's views on perception depending on his analysis presented in *Substance and Function*. The main themes are; what is the nature of perceived object, is it a simple aggregation of impressions, or an outcome of a structural process through which mind constructs the object? In addition, there was another theme implied in his Substance and Function that perception is a view on the whole and any reference to the whole always requires a peculiar function that is not deduced from

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sensation but presupposed. Cassirer rejected the view that object is given to us in experience, which is why he opposed the Associationists. If we considered that his *Substance and Function* was an epistemological enterprise that aimed to introduce a new understanding of knowledge based on a new logical base called Functional-Relational thought, then it will be our task to investigate how a theory of perception could be formulated in respect of that thought. Cassirer started his view on perception by criticizing Aristotle and empiricists by arguing that there is a priority of relations over sense data of perception:

The category of relation especially is forced into a dependent and subordinate position by this fundamental metaphysical doctrine of Aristotle. Relation is not independent of the concept of real being; it can only add supplementary and external modifications to the latter, such as do not affect its real "nature". In this way the characteristic feature, which has remained in spite of all the manifold transformations it has undergone. The fundamental categorical relation of the thing to its properties remains henceforth the guiding point of view; while relational determinations are only considered in so far as they can be transformed, by some sort of mediation, into properties of a subject or of a plurality of subjects. (Cassirer, 1923: 6).

In fact Cassirer refused the Aristotelian concept of "relation" which presupposes a reference to the existence of the objects. Cassirer characterizes Aristotelian logic and the empiricists as their views based on "substantial thought" as we pointed out previously. Cassirer argued that both Aristotelian and empiricism had the same approach of explanation where both approaches refer to the objects and their characteristics not to relations that are presupposed to classify the objects. The only difference that Cassirer found between Aristotelian views and empiricism was that there was a transformation that took place instead of studying the external world and its objects; the concern of empiricism was the internal world of consciousness and the representation of the external world.

Cassirer extended his criticism to include the empiricists such as Locke, Berkeley, Hume and Mill. Cassirer rejected empiricism where the thought is concerned with the collection of the properties and gathering them under one general object, as in the case of the gold object

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The “psychology of abstraction,” according to this view, furnishes the real key to the logical meaning of every form of concept. This meaning is derived from the simple capacity of reproducing any given content of presentation. Abstract objects arise in every perceiving being in whom like determinations of the perceived have been given in repeated presentations. For these determinations are not confined to the particular moment of perception, but leave behind them certain traces of their existence in the psycho-physical subject. Since these traces, which must be thought of as unconscious during the time between the real perception and the recall, are again aroused by newly occurring stimuli of a similar sort, a firm connection is gradually formed between the similar elements of successive perception. (Cassirer, 1923: 10-11).

I explained in Chapter Two that, Cassirer opposed any attempt to ascribe any form of constancy to the sense data. He indicated the close relation between the Aristotelian view and empiricism of perception:

The difference between the ontological and psychological views is merely that the “things” of scholasticism were the beings copied in thought, while here the objects are meant to be nothing more than the contents of perception. (Cassirer, 1923: 10-11).

He also explained the substantial foundation of the empiricists like Locke and Hume regarding perception:

In this polemic against the concept of substance, Locke believes he has struck the real kernel of all metaphysics and all scholastic explanation of reality. And after Hume has transferred its result from outer to inner experience, the work of criticism seems ended. The substance of the *ego* seems now explained away like the substance of the *thing*; mere associative connections of presentations take the place of both. In spite of all this, the view of physical and psychical reality, that is constructed on these foundations, has in it the general *category* of substantiality in its decisive meanings. Only the applications of this category have been changed, while it itself retains its old rank and position unnoticed. The substantiality of the “soul” is only apparently done away with; for it lives on in the substantiality of the sensuous “impression”. After, as before, the conviction prevails, that only that is truly real” and the ground of the real, which stands for itself alone and is intelligible purely of itself as an isolated existence. (Cassirer, 1923: 331).

Cassirer applied Functional- Relational thought to perception to support his claim that the sensuous elements of any perceived object are not simply aggregated and chaotically combined together without order or reference. Rather, the sensuous elements are ordered in

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respect of various possible forms and hence phenomenologically represent them differently. According to the Functional- Relational view, the peculiar feature of perception is that perception is no longer a theory of independent and unchangeable qualities that its combination represents one particular and definite object. Rather, perception, in respect of Functional-Relational thought becomes an account of representing the parts of the perceptual situation differently depending on the form within which mind reconstructs the perceptual situation and fits the elements in a new order of arrangement.

Therefore, we can say that the structural aspect of perception, as discussed on the basis of functional thought can be shown in the organization and the arrangement of the elements of perceived objects. The relationships between the parts of perceptual situation are changeable when the form of arrangement changes. Therefore the representation of an object in a perceptual situation can be reformed differently when;

- 1- There is a shift in a point of reference.
- 2- The mode of relation can be changed.

It is not the issue that are perceived object is determined as having independent characteristics that remain unchanged even when the conditions of perceptual situation change. But it is the structures that provide the object with new forms of arranging and hence new characteristics will emerge and perceived. Cassirer affirms that meaning by referring to the Gestaltists as an answer to the question of how an object can be represented differently when we change our point of reference. To show what happens, he uses the phenomenon of “optical inversions” when a shift in our point of reference takes place, another object can be represented and perceived

One and the same optical complex can be transformed now into this, now into the spatial object, can be “seen” as this or as another object. Such inversions are neither errors of judgment nor mere ideas, but genuine perceptive experiences. (Cassirer, 1957: 158).

Cassirer's account of perception shows that perception no longer deals with objects as given, rather with structure where the objects and its characteristics are generated through the whole system. In fact, Cassirer’s view on perception based on functional thought where

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stress is given to "structure" that presupposes the form of arrangement and it is not a sign of what is "given" in experience.

This logical account of perception sets itself up on the assumption that there is a tension between psychology and epistemology. If Functional-Relational thought is applied to modern scientific theories, then Cassirer also sought to apply it to psychology. In doing that, Cassirer transcended the traditional explanations given to the facts of psychology. Cassirer brought psychology to the wide circle of epistemology by examining perception, as an example, applying functional-relational thought as a new approach to deal with perception. Cassirer calls psychology that uses the functional-relational approach as "*psychology of thought*" as he stated it in his *Function and Substance*. Cassirer sought to make psychology a cognitive discipline concerned not with the facts of sensuous perception but as an example to discover the complex and constructive processes of conceptual understanding in their fundamental features. Psychology is not a study of sense data given to individuals in perceptual experience; rather it is a system of arranging the chaos of experience in systematic orders. The representation of the objects is a process submitted to the structural orders as being independent from the objects given in experience. Cassirer aimed here to confirm that a particular perception may assume very different meanings and values for the total structure of the objects in reality. Cassirer refers to this idea that the psychology of thought is concerned with construction and meaning of perception of objects, not the object as simply given in experience.

It does not study thought where thought merely receptively receives and reproduces the meaning of an already finished judgmental connection, but where it creates and constructs a meaningful system of propositions. When psychology pursues this line of inquiry and considers thought equally in the concrete totality of its productive functions, the initial opposition of methods is more and more resolved into pure correlation. Psychology in this sense gives approach to problems, which must seek their solution in logic and in their application to science. (Cassirer, 1923: 364).

Here we can now notice this epistemological approach mainly expresses continuous processes of free creation of objects. In other words, the theory of perception could achieve

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meaningful progress when it shifted from emphasizing percepts to concepts. (Cassirer, 1944: 17).

Cassirer went a step further in his analysis of the structural processes involved in perception by adjusting another modern psychologist's view. In his discussion of Christian Von Ehrenfels's essay *Über Gestaltqualitäten* 1890, Cassirer picked up the initial thread to reinforce his view regarding the structuralism of perception. Ehrenfels's essay achieved two goals for Cassirer;. Firstly it gives him a good way of showing that psychology in general, and perception in particular, reinforced his view of the possibility of giving a critical analysis to perception on structural foundations. Ehrenfels's essay discussed the term (form- quality) that reflects the possibility of arranging the perceptual contents in respect to a form, a structure or a whole.

The most famous example is the melody discussed by Ehrenfels. But the significance of Ehrenfels's work for Cassirer's structuralism was also that Ehrenfels confirmed that what connects the parts of the object into one form or whole is not to be found in these contents themselves nor in the coexistence of the qualities as an aggregate. Rather it is a new function that is an independent structure that re-arranges the relations between the parts of the whole. The importance here is given to the structure to the whole not to the parts. The parts of the whole acquire their meaning not independently but through the whole of which they are part. Therefore, Cassirer considered the works of Ehrenfels to be a turning point in the psychology of perception:

The elements never "subsist" outside of every form of connection, so that the attempt to deduce the possible ways of connection from them moves in a circle. Only the total result itself is "real" in the sense of experience and psychological process, while its individual components have only the value of hypothetical assumptions. Their value and justification accordingly is to be measured by whether they are able to represent and reconstruct in their combination the totality of the phenomena. (Cassirer, 1923: 335).

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Secondly, Ehrenfels's investigation opens the door for Cassirer to deeply engage himself with the Gestalt School of Psychology, and their application to different psychological problems like perception, memory, abstract thinking and learning. Now let us discuss what are the epistemological and logical implications that are included in the Gestalt- Qualities?

3-4 The Epistemological Foundations of the Gestalt School

I will now discuss the epistemological and logical views of the Gestalt theorists which are presented in their discussions of the theory of knowledge and its application to the field of psychology. Although it is difficult to trace their epistemological view since they do not state them explicitly, it is still possible to extract them from the fragments of their books. It is helpful to begin with their criticisms of associationism and behaviorism.

To understand their core objection against associationism and behaviorism, it is important to understand what the Gestaltists meant by Gestalt-qualities. They mean by Gestalt-qualities that any object we perceived involves holistic structures that are not deduced from experience and are not extracted from the parts of the objects. Rather, these holistic structures are given suddenly by insight and in the light of these structures, the perceptual experience is organized. The main theme of Gestalt school was the priority of holistic forms over the parts. This view will reflect their criticism of associationism.

Associationism can be defined as an attempt to explain mental phenomena through relations among mental contents and representation-particularly relations such as contiguity and resemblance that cause them to become associated with one another.

The Associationists argued that behaviour takes place when a physical stimulus hits any sense organs and accordingly the sense organs responses to the stimulus. It is an account that shows that behaviour is always a reaction to the stimulus and if we want to understand the motives of behaviour, we need to understand first the nature of the stimulus. Behaviour occurs in the light of that mechanism between stimulus and sense organs. As a result, the sense organ is a response to a part of the field of the experience not a response to the

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situation as considered as one systematic structure instead. For example, an animal behaviour, according to the behaviourists is a direct response to the stimulus of the situation. The behaviourists presented different researches and studies on human and animal all showed in fact that the behaviour is a response to the stimulus. These experiments were presented by Pavlov and Skinner on animal behaviour as we shall discuss later. However, the Gestaltists indicated that both human and animal behaviour are a response to the total situation of perceptual field. They explained that the human and animal response is determined not by one element as a stimulus, but by all the elements involved in the total situation. This difference in their approaches led the Gestaltists to present their views on the creative thinking and problem solving as ways to show that behaviour is always a response to the whole perceptual situation. The peculiar epistemological situation of the Gestaltists is that they indicated that behaviour is a response to the whole or structure not to parts themselves. I can make some general remarks on the Associative approaches in perception as the Gestaltists discussed them.

1- The central idea of Associationism relies on a belief that complex wholes are concatenations of units, elements, or atoms combined together in a certain way. The Associationists sought to explain mental phenomena through relations among mental contents and representation-particularly relations such as contiguity and resemblance that cause contents to become associated with one another. Perception takes place when the parts of a perceptual situation are combined together in a certain relation to give the whole perceptual situation. According to the Associationists, the parts or the elements of perceptual experience are prior to the situation as a whole. On the contrary, the Gestaltists rejected association as the basis of a reliable account of perceptual experience. We can see Wertheimer, the real founder of the Gestalt school, uses the phrase “bundle hypothesis” to characterize the theory considering experience as a companion of elements.

2- The second objection was centered on the idea of “the Constancy Hypothesis” which states that the perceived object will have the same qualities and properties even under changes in the perceptual field. According to the Associationists, the object we perceive

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reflects what exists in the external world without any changes. For example, I perceive a friend from a far distance, and the way he is represented to me involved no changes similarly as if I perceive him from close distance. Although there are differences in the ways of representing him from close and far distances, but still he looks to me the same friend without any changes. The Gestaltists rejected the principle of constancy because it does not deal with slight changes taking place in perceptual experience and is concerned instead with the fixed characteristics. The Gestaltists distinguished between the physical object in the external world and the way it appeared to me when I perceive it. For instance, in their example of animation movies the pictures in themselves are mere aggregates if I add them together nothing happens but these pictures seem to move when I display the pictures in a quick succession. The Gestaltists were against the claim that objects have unchanged properties and hence will be perceived as they are in reality. However it is understood in the light of their distinction between the objects as things and the objects as appearance as we will discuss later. (See Chaplin & Krawiec, 1974: 61, also Reed, 1988: 32).

3- The third objection raised by the Gestaltists against Associationism related to the idea of One – to- One correspondence between physical stimuli and the states of sense organs. They treated the nervous system as a complicated mechanism of separate conductors. When there is a response from sense organs to stimulus, there is a current run from the nervous system to the sense organs and then the sense organs respond in respect to the sign sent from brain to sense organs. (Heidbreder, 1961:337-342 also Rivera, 1976: 235 Watson, 1963: 410).

The behaviourists took this fact as a model of explaining how there is a mechanism involved in the way behaviour responses to the stimuli.

On the contrary, the Gestaltists tried to bring their understanding of physiology and claim that there is isomorphism between the processes taking place in the nervous system. For the Gestaltists, *isomorphism* refers to a correspondence between a stimulus array and the brain state created by that stimulus. For example, in the Phi-Phenomenon it is argued that the



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brain state created by this stimulus matches the brain state created by a patch of light moving between the two locations. We shall explain the phi- phenomenon in Chapter Five. The Gestaltists took another different model of explaining the facts of behaviour distinguished from the mechanism model that adjusted by the Associationists. This model stresses the priority of the functions performed over the stimuli, and the behaviour is a reflection of these functions not to stimuli.

These features of criticism show the holistic view of the Gestaltists's view. They believe that any attempt to break the whole down into elements would destroy the essential structure of the whole. "The whole is greater than the sum of its parts" is a phrase that summarizes this conceptual approach toward the investigation of epistemological claim. (Dember & Warm, 1979: 253-254).

The Gestalt scientists developed their ideas in the light of the new developments of modern sciences and implemented those ideas to psychology. In addition, they checked out the early writings of the Gestalt pioneers such as Ehrenfels and started to criticize his early views in respect of new developments of modern sciences. The question now what were the difficulties that they found in Ehrenfels's theory of perception?

Before answering the previous question, it is important to highlight Ehrenfels's main idea of perception. Ehrenfels is an important precursor of the Gestalt school who sought to find an answer to that question, how it is possible to recognize the melody, say nine notes, played in the key of C, after hearing these played in a different key, let us say F. The conclusion according to him was that there was in addition to the nine sensory elements, a tenth element which is the Form-Quality or Gestaltqualitat of the nine unit tones. It is through that agency that we are able to perceive the resemblance of the two melodies, although every note in one series is different from the corresponding one in the other. (Roback, 1952: 302-303 also Kanizsa, 1979: 51-52 And Reed, 1988: 33).

The notion of Form-Quality played an important role in formulating a distinction between associationists who gave the priority to the elements over the form from one side and that

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holistic view that gives priority to the structure over the elements. Gestalt theorists like Max Wertheimer and K. Koffka criticized Ehrenfels's notion of Form-Quality, however they claimed that the idea of high element that we add to experience is not an accurate hypothesis in the light of the new evidence emerging in the field of both physics and physiology. For example, Koffka distinguished between the notion of Form- Quality and the notion of Gestalt since the former idea is ambiguous and it adds a new element to the rest of the sensuous elements composing the perceptual experience (Koffka, 1922: 531-537 From Brennan, 1955: 191-196).

Although Ehrenfels presented a distinguished view of perception in trying to identify its nature, Koffka considered his view as supportive to the Elementalism approach since he confirmed the additive super element to the whole elements of experience. Koffka rejected Ehrenfels because he saw the relation exhibited in Form-Quality, which ties between the contents of experience to the acts or laws that generate them, as not clear. But I do not agree with Koffka's view on Ehrenfels because Ehrenfels defended the theme that there must be a structure presupposed to our experience not just only an important element simply added by chance to experience. Ehrenfels thought that perceptual experience presupposes an element that organizes it. This element is not given in experience. However, we can set Ehrenfels and his view of Form- Quality in a middle way between sensations and judgments. For he was concerned with the elements that compose the perceptual experience from one side, and he could not give as clear an account as the other Gestaltists who came after him like Wertheimer and Kohler.

The Gestalt theorists believed that there is a pattern or context that is logically prior and precedes the parts that can be organized in the light of that context or whole. There is a holistic context in which we understand the elements. For example if we see two words; the word (Act) and (Cat) although they have the same letters, they have completely different meanings because the letters are grouped and ordered in two different contents. (Klein, 1970: 63-64). The notion of the whole presented by the Gestaltists refers to the question of

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the possibility of arranging the elements of perceptual experience in different wholes or systematic orders (Muller-Freienfels, 1935: 113-114 Also Averill, 1976:11).

It is necessary now to discuss the pure Gestalt account as it is presented by the real founders of the Gestalt School.

3-5 The Gestalt and the Structural Foundations of Perception

I will now discuss the foundation and consequences of the structuralism of the Gestalt theory of perception. First I will attempt to define “structure”. Structure is a presupposed order that is needed to form the experience. It is the presupposed condition that transforms perception as mere representation of figures to representation of forms. In other words, it is the condition that distinguishes the outcome of the retinal image from the outcome of the phenomenological image. The most common feature is that “structure” involves a presupposed inner systematic coherence that relates the elements of one form where the form logically precedes its parts.

Jean Piaget provided an attempt to understand structure in respect of the transformations that take place between the elements. He also confirms the priority of laws over the elements:

We may say that a structure is a system of transformations in as much as it is a system and not a mere collection of elements and their properties, these transformations involve laws. (Piaget, 1971: 5).

The Gestaltists have their own account of structuralism. Although there are differences in their views of structuralism, still their views involve the priority of laws over the elements. For example, Wertheimer shows that in his version of structuralism in 1922 where he confirms the importance of the laws over the parts:

Gestalts are not the sums of aggregated contents erected subjectively upon primarily given pieces.... Instead, we are dealing with wholes and whole processes possessed of inner intrinsic laws. Elements are determined as parts by the intrinsic conditions of their wholes and are to be understood “as parts relative to such wholes”. This is the central formula of the Gestalt psychology. (Wertheimer, 1922: 43 from Ellis, 1950: 14-15).

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He also gave a similar meaning to that when he explained the nature of the Gestalt as a reference to his structuralism. Wertheimer explained the nature of the Gestalt in terms of the whole or structure that arranges the relations between the parts: A Gestalt is a whole whose characteristics are determined, not by the characteristics of its individual elements, but by the internal nature of the whole. (Wertheimer, 1922:13).

He was concerned more that the characteristic of the whole is not something that is ascribed to the elements of the form, but instead this characteristic is deduced through the internal unity and the systematic consistency between the elements as arranged under a form.

Kohler also presented his view on structuralism which also raised the idea that any kind of arrangement of the parts presuppose a functional activity that orders the relations of the elements:

Sometimes the term “structure” is used in a purely geometrical sense. But when I use the term in our present connection, it refers to a functional aspect of processes, to the distribution of such processes. A distribution which they assume (and may also maintain) as a consequence of the dynamic interrelations or interactions among their parts. (Kohler, 1969: 91-92).

The Gestaltists’ idea of “whole” shares the same meaning of structuralism. For them, the Gestalt is synonym to “order” and “form”. They argued that the whole always precedes its parts, and the whole is the form that is recognized first before the contents. From this view, we can see that the Gestalt as a view of “Holism” or “Wholism” and “Structuralism” share the same idea that relations have priority over elements and both structuralism and Wholism considered and emphasized that relata have to be considered as places rather than individuals.

Both Wertheimer and Kohler confirm the notion of the whole and its role in arranging the parts in a systematic manner. This arrangement does not come randomly but emerges through a logical process.

The Gestalt approach is based on a general view presented in Max Wertheimer’s lecture was delivered in 1913 in Frankfurt. The central topic of that lecture was about the general

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themes involved in Gestalt. Wertheimer identified himself as the founder of that new school of psychology by presenting new ideas that can be summarized as follows:

1- The structures that organize the impressions are called “*Relational Contexts*”. These Relational contexts are not the outcome of simple aggregations of the parts or sensual elements. On the contrary, they are wholes that are generated a priori before the parts. The structure of the whole develops and is grasped before the individuals that shape the contents of the consciousness.

2- Wertheimer emphasized the perceptual experience is organized in respect to structures. He explained that it is the totality of conditions that determine and affect any individual in the perceptual situation not the individual himself. For example, the individuals alone are not insufficient to determine the experience. (Ash, 1998: 123-124).

We conclude from what has been discussed that the notion of “structuralism” is considered to be the background of the Gestaltists on which they provided their contributions and analyses to form a different account of psychology.

Cassirer's View of Perception and Group Theory

4-1 Introduction

The main concern of this chapter is to investigate the reasons why Cassirer chose mathematics, group theory in particular as a framework to present his view of perception. Cassirer's was aware of the modern development of mathematical thought and he applied that understanding to perception. Cassirer chose to apply the "*Erlanger Programm*" of Felix Klein to perception. Therefore the main question of this chapter will be: how successfully could Cassirer build up a theory of perception based on a mathematical view? Therefore our argument will include Cassirer's distinction between two different views of perception. According to the first view, what we perceive is an aggregation of different qualities of something that exists in the external world that have independent qualities. Cassirer calls this view the traditional view of perception. According to the second view, what we perceive is perceived with respect to certain a structure. What we perceive will be ordered into that structure and its properties are transformable in respect to different frame of reference. This second view Cassirer calls 'the invariant account of perception'. Finally we will see how his theory of invariant theory of experience is able to give a new account of perception.

Cassirer used the mathematical concept of group in the domain of perception to claim that the perceptual experience can be considered as an objective experience distinguishing it from dream and hallucination. The application of group theory allowed Cassirer to trace the constant elements involved in the contents of object we perceive in visual experience. In virtue of these constant elements that remain unaltered during the changes take place in perceptual situation, led Cassirer to claim that there are similarities should be taken into consideration when we construct both geometrical and perceptual objects. The construction of perceptual object presupposes constant elements involved in the contents of the object

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which orders and groups the contents of object. Setting perception on that understanding of group theory will lead to the conclusion that perceptual judgments are possible.

4-2 Cassirer on the Epistemology of Geometry

The Euclidean geometrical system attracted different mathematicians, physicists, and philosophers to support its validity and show that it does not have internal inconsistency within its axioms. Therefore they found that the axiom of parallels is inconsistent with the Euclidean axioms. The axiom of parallels states through a given point one and only one parallel can be drawn with respect to a given line, that is, there is one and only one line that does not intersect with a given line and yet lies in the same plane. The nineteenth century witnessed a drastic movement of changing the epistemology of geometry. Gauss, Bolyai, Lobachevski, Riemann and Klein made significant contributions in the development of non Euclidean geometrical systems. The problem for the philosophers of nineteenth and early twentieth centuries was that of whether or not the Kantian synthetic a priori judgements are valid to explain the nature of non Euclidean geometries. The discovery led to a critical change in other fields particularly physics and philosophy. There was continuous debate among them to answer, how these new geometrical systems presented physical space, and how they could present different accounts transcending Kant's Critique based on the trustworthiness of Euclidean geometry. That led philosophers, mathematicians, and physicists to direct criticism toward the Kantian philosophical system and his theories related to geometrical space and physical space.

Kant developed his view of synthetic a priori knowledge that although knowledge is independent of sensible experience, yet still it is applicable to the empirical physics of Newton that exemplified such synthetic a priori knowledge through its reliance on Euclidean geometry and the fundamental laws of motion. Kant's theory of a priori faculties of the mind was aimed to explain the origin of synthetic a priori knowledge and thus make Newtonian mathematical physics comprehensible. Kant pointed out that we must have an a priori intuition of space because geometry is a science which determines the properties of

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space synthetically and yet a priori. Let us take some examples of that criticism raised against the Kantian view of space.

Hans Reichenbach is a logical empiricist who supported the role of experience in epistemology and even in exact science. He was trying in his earlier works to reconcile Kant and Einstein, as is shown in his correspondence with Cassirer, but later he departed from the Kantian view of the a priori. In his 1956 *The Theory Relativity and A Priori Knowledge*, Reichenbach distinguished between two meanings of a priori implied in Kantian view. A priori refers to a necessary, unrevisable and fixed for all time, on the one hand, and constitution of the object of knowledge on the other hand:

Kant's concept of a priori has two different meanings. First, it means necessarily true" or "true for all times" and secondly, "constituting the concept of object". The second meaning must be clarified. According to Kant, the object of knowledge, the thing of appearance, is not immediately given. Perceptions do not give the object, only the material of which it is constructed. Such constructions are achieved by an act of judgement. The judgement is the synthesis constructing the object from the manifold of the perception. (Reichenbach, 1965: P48).

Reichenbach argued, on the basis, that the great lesson of the theory of relativity is that the former meaning must be dropped while the latter must be retained. Relativity theory that is, involves a priori constitutive principles as a necessary presupposition of its properly empirical claims, just as much as did Newtonian physics, but these principles have essentially changed in the transition from the latter theory to the former.

He also indicated that there is no role for the synthetic a priori judgements to play in the non-Euclidean geometries.

There is no synthetic a priori of geometry: either geometry is a priori, and then it is mathematical geometry and analytic- or geometry is synthetic, and then it is physical geometry and empirical. The evolution of geometry culminates in the disintegration of the synthetic a priori. (Reichenbach, 1951:14).

In *The Philosophy of Space and Time* 1928, Reichenbach argued that the geometrical structure of physical space is a matter to be decided not a priori, but by empirical science.

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Reichenbach pointed out that Euclidean geometry is not the only possible alternative to represent the physical world, but the discovery of non Euclidean geometries paved the way, that there are possible forms of representing the physical world.

Reichenbach's empiricism let him reconstruct knowledge generally and scientific knowledge in particular, without recourse to the synthetic a priori in any form. Reichenbach had a version of a theory of the verifiability of meaning, according to which a statement will be held as cognitively meaningful when it is possible to obtain evidence which will give the statement some degree of probability. This view led him to apply it to geometry. He claimed that geometrical statements must have a meaning that refers to empirical knowledge. Reichenbach rejected both Cassirer's view and transcendental philosophy. He claimed that the functional conception of knowledge, as used by the Marburg school was misleading because he thought that knowledge refers to an external world that transcends experience. In contrast to the Marburg school's interpretation of the functional conception of knowledge, Reichenbach argued that the philosophy of the new empiricism understands functional knowledge as it portrays the things of this world. Therefore, he considered knowledge as an instrument of predication and for which observation is the only admissible nonempty criterion of truth (Reichenbach 1951, 252-255)

Reichenbach's criticism of the idea of synthetic a priori extended also to include the Neo-Kantian views of space, particularly the Marburg School. Cassirer showed that space is prior to all things which determine it. It is a form to order the contents. Cassirer tries to find room for the Kantian method to match with empirical science. Although Reichenbach disagreed with the attempts made by Cassirer to justify the Kantian view on space, Reichenbach pointed out that Cassirer tried to give new interpretations to Kantian doctrines regarding space and time. Therefore, Reichenbach ascribed him as the one who awakened Neo-Kantianism from its "dogmatic slumber."

Cassirer... therefore abandons the idea of interpreting pure intuition in Kant's sense. He separates the metric from intuition and takes pure intuition to be the general law of coexistence that even Riemannian geometry retains. According to Cassirer, the metrical axioms are no longer dictated by pure intuition.

Riemann began by searching for the most general type of three dimensional manifolds; in this manifold,

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Euclidean “plane-space” turns out to be a special case resulting from a certain form of metric. If one takes as the space of pure intuition this general Riemannian structure which has a certain continuity and order properties but which leaves the choice of the metric open, all contradictions in the theory of relativity disappear. (Reichenbach, 1965: xxix).

Rudolf Carnap also rejected the idea of space as a synthetic a priori form. Carnap belongs to the movement called “logical positivists” who believed that knowledge of reality begins from perceptual experiences, which underlies all sciences. Carnap calls perceptual experience elementary experience. He claimed that all we know of the world starts from there. Therefore the problem of the external world is a meaningless issue simply because there is no possible way of verifying whether there is or there is not an external world independent of our experience. This logical positivist view informs Carnap's conception of space. He pointed out that the nineteenth century dispute between mathematicians, physicists, and philosophers regarding the nature of space is barren because the different competing points of view are in fact referring to different types of space, so there was nothing actually to dispute. Regarding that understanding, Carnap indicated that there are three kinds of space; *Formal space* is a pure relational structure developed within the new mathematical logic (Russell) and this space is correct. *Physical space*, by contrast, is an object of empirical natural science where the physicists's views (Helmholtz, Einstein) are correct. Finally *intuitive space* is an object of a priori intuition where (Kant and neo-Kantian) views are correct (Friedman, 2002: 64).

Carnap was interested in space and tried to explain its nature through linguistic frameworks. He wanted to make all these different accounts of spaces equivalent from the point of view of language.

On the other hand, if we are dealing with the space of our universe, a space we cannot observe as something embedded in the space of a universe of higher dimension, then it is meaningless to ask whether space is non- Euclidean or whether our laws have to be modified to preserve Euclidean geometry. The two theories are merely two descriptions of the same facts. We can call them equivalent expression because we make exactly the same prediction about observable events in both theories. (Carnap, 1995: 150).

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Although when he was young, he was impressed by the Kantian view that the geometrical structure of space is determined by the form of our intuition, Carnap departed from the idea of intuitional space after Einstein's relativity theory emerged. The reason for Carnap to abandon intuitional space was that it involves synthetic a priori judgement. In the light of non- Euclidean geometry, he argued that Kant was mistaken when he considered that Euclidean geometry and three- dimensional space is secured by a priori intuition. Carnap aimed to show that three dimensional space is not intuitional but it is empirical:

Knowledge of intuitive space I regarded at that time, under the influence of Kant and the neo-Kantians, especially Natorp and Cassirer, as based on "pure intuition" and independent of contingent experience. But, in contrast to Kant, I limited the features of intuitive space grasped by pure intuition to certain topological properties; the metrical structure (in Kant's view, the Euclidean Structure) and the three-dimensionality I regarded not as purely intuitive but rather as empirical. (Carnap, 1963: 12).

It is not only Carnap but also Mortiz Schlick who attacked Kant and the neo-Kantians, especially the Marburg school members, for their understanding of geometrical space. They supported the idea that priori principles constitute the firm ground of all exact science and geometrical space. Therefore Schlick challenged the Marburg school members to give him examples of synthetic a priori principles. When Schlick explained the uselessness of synthetic a priori for exact knowledge, he pointed out that Einstein's theory of relativity has nothing to do with synthetic a priori (Schlick, 1921: 325 Also Schlick, 1974:148-358).

As another example presented by Cassirer of the dispute about the nature of geometrical space, Henry Poincare deals with the problem of space. Poincare was against geometrical empiricism and he claimed that the space of geometry is not the space of sense experience. He explained that the development of non-Euclidean geometries showed that Euclidean axioms do not, as we supposed before, state fundamental properties of observable space. He showed that coherent systems of geometry can be constructed based on the denial of Euclidean geometry axioms. Poincare argued also that geometrical axioms are not synthetic a priori truths because they are not necessarily true, and are not experimental truths either. However, he concluded that geometrical axioms are conventions. What he meant by conventions is that such axioms are neither true nor false. They are adopted because they

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are useful in describing the world. Poincare supported the idea that experiments tell us only about the relations between bodies and nothing about the relations of bodies to pure geometrical space, or parts of this space to each other. For Poincare the geometrical object is not experimental but conventional.

The object of geometry is the study of a definite group, but the general idea of the group pre-exists, at least potentially, in our mind, having forced itself in not as a form of sensibility but as a form of our understanding. All we have to do is to choose among all possible groups the one that will constitute a standard for us, as it were, to which natural phenomena are referred. Experience guides us in this choice but does not dictate it; nor does it permit us to know which geometry is truer but only which is more "useful. (Poincare, 1946: 90, quoted from Cassirer, 1950: 43).

Cassirer was aware of these philosophical justifications of non- Euclidean geometry presented by these philosophers. Cassirer offered strong Kantian sympathies which are evident throughout his work and in a number of ways the analyses developed in it are a reworking of the argument of *Substance and Function* brought up to date in the light of more recent advances in knowledge. What Cassirer is trying to do is to develop his view on the epistemology of geometry depending on the Kantian transcendental method. Cassirer was thinking that the Kantian transcendental method is still applicable to non-Euclidean geometry. Cassirer was aware that some of Kant's doctrines are not valid where applied to new geometrical systems. However, Cassirer sought to separate the Kantian method from his doctrines and applied it to non Euclidean geometry. For example take the idea of pure intuition; Cassirer tries to give a new meaning to it by abandoning the Kantian interpretation of pure intuition and makes the transcendental philosophy match with the new developments brought up by the theory of Relativity:

But the transcendental philosophy does not have to do primarily with the reality of space or of time, whether these are taken in a metaphysical or in a physical sense, but it investigates the objective *significance* of the two concepts in the total structure of our empirical knowledge. It no longer regards space and time as things, but as source of knowledge". It sees in them no independent objects, but "conditions of the possibility of experience," conditions of experiments and observation themselves, which again for their part are not to be viewed as things. (Cassirer, 1923: 411).

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Cassirer was interested with the following question, is geometry an empirical or ideal activity? For Cassirer, the most radical removal of geometry from experience had already occurred with Euclid, which was already based on figures that are removed from all possibility of experiment. Not only the idealizations of point, line, and plane, but the idea of similar triangles, whose differences are considered inconsequential or fortuitous, and that become identified as "the same" marks an immense step away from ordinary perception.

Cassirer pointed out that when Riemann published "On the Hypotheses Underlying Geometry" (1868) the axioms of Euclid, which had been regarded for centuries as the supreme example of eternal truth, now seemed to belong to an entirely different kind of knowledge. For Cassirer, "the whole problem of the truth of mathematics, even of the meaning of truth itself, was placed in an entirely new light. Until that time, both rationalist and empiricist philosophers had agreed that the relations of mathematical ideas were rigorously necessary and unalterable. How could entirely different and wholly incongruous systems of geometry uphold the claims of truth?

He quotes Henri Poincaré's observation that no matter what observational facts are found, the physicist is free to ascribe to physical space any one of the mathematically possible geometrical structures, provided that he makes suitable adjustments in the laws of mechanics and optics and consequently in the rules for measuring.

Ernst Cassirer shows Poincaré's assessment of the impact of non-Euclidean geometry as a shift in the meaning of mathematical axioms. For Cassirer, the theory of sets had shown that the different geometries were all equally true in an ideal and mathematical sense. Geometry could be defined as a theory of invariants in respect to a certain group -only properties that are characterized by invariance with respect to certain transformations can be called "geometrical." While Euclidean geometry applies to a "basic set" of rigid bodies that are freely movable in space without changing form, different transformations can be applied to different sets of objects (defined as "same" with respect to a particular criterion). For Cassirer, the modern sense of axioms differs from the ancient. Axioms are no longer

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assertions about content that have absolute certainty; rather they are proposals of thought that make it ready for action. (Cassirer, 1950: 45).

Cassirer believed that modern developments in the exact sciences go far to confirm the Kantian interpretations of them. In fact, Cassirer gives a pronounced instrumentalist interpretation of Kantian doctrines. For example, he declares that the axioms of geometry can no longer be regarded as “assertion about contents that have absolute certainty, whether it be conceived as purely intuitive or rational. They are rather proposals of thought that make it ready for action-thought devices which must be so broadly and inclusively conceived as to be open to every concrete application that one wishes to make of them in knowledge. It was a general view of Cassirer’s view of epistemology that shows he was aware of the philosophical controversies about the nature of geometrical space due to the emergence of non-Euclidean geometry.

4-3 Cassirer and the Concept of Object

If we take the concept of reality into our consideration, then the mind would have two views concerning reality. A simple view understands reality as being composed of independent objects. Therefore there is always dualism between mind and reality. The objects of reality are isolated entities that need a certain kind of order. The structuralist, in contrast, understands reality as a structured whole, constructed and grasped by the mind. The structuralist considers the normal mode of existence of objects is in virtue of the relations that constitute them or into which they enter; in the case of concretely existing objects it is their meanings, rather than their physical properties.

Cassirer rejected the idea that objects can have an existence independent of thought. Every object has to be developed within thought.

Direct perception always offers us only isolated fragments, only entirely discrete values, which in no combination constitute a continuous whole. The truly “seen” and “heard” furnishes only disconnected, temporally separated masses of perception; while the concept of “object” requires the perfect filling of the time series, and thus, strictly speaking, requires the assumption of an infinite totality of elements. Thus at this second level, the general procedure is clearly revealed for transforming and enriching the given, on

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the basis of the logical demand for its thorough-going connection. It is on the continuation of this procedure, that science bases its definition of nature and the natural object. The logical tendencies found in the concept of experience of the ordinary view of the world are now consciously taken up and carried further with methodic purpose. The things" that arise henceforth, prove, - the more distinctly their real meaning is comprehended, - to be metaphorical expressions of permanent connections of phenomena according to law, and thus expressions of the constancy and continuity of experience itself. This fixity and continuity is never fully realized in any sensuously perceptible object; so in order to reach it, thought is led to a hypothetical substructure of empirical being, which however has no other function than to represent the permanent order of this being itself. (Cassirer, 1923: 276-277).

Cassirer's view of object has nothing to do with the things, rather he refers to it as a constitutive condition of all experience. Cassirer as a structuralist was more concerned with the constitutive law of the particulars.

The necessary guiding concepts of association cannot arise from association itself, but belong to another field and logical origin. If it is once understood how knowledge attains a constancy of certain predicates and establishes judgmental connections, then the "transcendence" of the object as opposed to the mere presentation no longer offers any difficulty. And the means used by knowledge are shown to be the same in both fields of problems. Just as the real achievement of the concept is not in "copying" a given manifold abstractly and schematically, but in constituting a law of relation and thus producing a new and unique connection of experiences that transforms changeable "impressions" into constant objects. In fact, the most general expression of "thought" is the same as the most general expression of "being." The opposition, that metaphysics could not reconcile, is resolved by going back to the logical function from the application of which both problems arose, and in which they must finally find their explanation. (Cassirer, 1923: 286).

Cassirer confirmed the importance of relations over separated entities. Felix Kaufmann in his paper *Theory of Scientific Knowledge* (1949) devoted to Cassirer, argues that Cassirer was against ontology and he quoted a sentence from Axel Hagerstrom (1939) to show how Cassirer's anti-ontological views fitted in to that context:

That the general birch- tree "exists" can only mean that what is to be stated by it is not a mere name, not simply a *flatus vocis*; the statement is meant to refer to *relations* of the real. We express by the notion "general birch-tree" merely the fact that there are *judgments* which do not refer to this or that- here and now given- birch-tree, but claim to apply to "all" birch-trees. I can uphold this logical participation, this

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of the particular in the general, without transforming it into an ontological statement in which two fundamental forms of reality are posited. (Kaufmann, 1949: 208-209).

According to Cassirer, the traditional Associationism misunderstood the relation between the universal and the particular. Cassirer indicated that universal, order and structure must logically precede individuals. From that understanding Cassirer formed his view of object. The question now is, how did Cassirer develop his view of the object and how did he understand the objects of different domains of knowledge?

To answer this question, one needs to be aware of the dichotomy between substance and function. Throughout his philosophical writings, Cassirer sought to clarify the real meaning of 'object' by sketching it in light of functional- relational thought.

For objectivity itself- following the critical analysis and interpretation of this concept- is only another label for the validity of certain connective relations that have to be ascertained separately and examined in terms of their structure. The tasks of the criticism of knowledge ("Erkenntniskritik") is to work backwards from the unity of the general object concept to the manifold of the necessary and sufficient conditions that constitute it. In this sense, that which knowledge calls its "object" breaks down into a web of relations that are held together in themselves through the highest rules and principles.

(Cassirer, 1913: Trans. In Ihmig, 1999:522).

Cassirer argues that the object, since it is not independent apart from thought, has not absolute characteristics or fixed qualities. But, the object is determined by the orders that form it and give it its characteristics. According to Cassirer, the object of knowledge, according to functional thought, has relative qualities that are acquired in regard to the position it occupies in the perceptual situation. Cassirer, in respect to modern psychological investigations, argues that the object that we perceive varies according to the changes in the conditions of the perceptual field. He explained that view when he discussed the object of perception. According to Cassirer, the object is developed when it is constructed not as it is simply given. Cassirer has that view when he was discussing the physical object:

With the demand that laws of nature be generally covariant, physics has completed the transposition of the substantial into the functional-it is no longer the existence of the particular entities, definite permanencies propagating in space and time, that form the "ultimate stratum of objectivity" but rather "the invariance of relations between magnitudes". (Cassirer, 1957:467).

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Cassirer applied that epistemological view of object to different concepts of science and reality as well. Cassirer emphasized the need to abandon a traditional and naive view of the world. Cassirer applies that view to the scientific concepts. He indicates also that such concept no longer refer to things but refer to relations. For example Cassirer applies this view to the concept of atom.

The quantum theory appears at first sight to require, more than any other theory in physics, a strict and "rigid" substance concept from which it cannot free itself. For its basic problem is that of atomic processes; and the very concept of the atom was always considered the perfect example, the prototype of substantialism. For it is precisely the stability of the atom which constitutes the basic problem of atomic physics; and how can this stability be accounted for theoretically when the presupposition of substantialism is discarded, when atoms are no longer regarded as rigid spheres? This, beyond doubt, represented a difficult task-but it is precisely the progressive solution of this problem, logically as well as physically, that is so significant for modern quantum theory. From the very beginning it could not accept the older interpretation of the atom as indivisible. It had to jettison the "simplicity" of the atom; instead it had to regard it conceptually as a most complex structure. The atomic concept changes from a simple "thing concept" to a relational and systematic one. We have seen that the new basic viewpoint in physics puts the concept of law ahead of the concept of thing; what a thing is can only be described by referring to the laws governing it. (Cassirer, 1956: 132-133).

Cassirer objected to the traditional and classical theories which understood the atom as an entity. This view has been given by Democritus who ascribed the properties of atom as solidity, rigidity and absoluteness. Cassirer claimed that this view of atom is developed with Galileo and "the mechanical world view". The concept of atom is based now on the empirical laws of motion and their mathematical formulation. These laws constitute the framework for the structure of atomism. The properties of solidity, rigidity, hardness and absoluteness are retained as visual aids but do not determine the basic character of the atomic theory. The theory of atom is now concerned with describing the action and the reaction of atoms, and the general rules for these interactions determine the conditions for the natural events.

Cassirer is focused now not on the things themselves but on our knowledge of things. Here, the influence of Kant on Cassirer's thought can be seen. For example if we choose the

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concept of causality, we can refer to the Kantian solution of the causality as guidance for Cassirer. Kant argues that the concept of causality does not apply immediately to the existence of things and their mutual interdependence. Rather it applies only to the form of our knowledge of things. Kant's aim was to comprehend all our experience of things under the faculty of understanding and its principles.

"All that we know in matter," says Kant, "is merely... relations but among these relations some are self-subsistent and permanent, and through these we are given a determinate object (Kant, *Kritik der reinen Vernunft* quoted from Cassirer, 1956: 182).

Cassirer went beyond the classical theory of atoms and set up his view in the light of quantum mechanics. Cassirer agreed that the atom acquires its characteristics through the position it occupies in the system and through the interrelations between its particles.

The question now is, why did Cassirer keep the Critical question of "How knowledge is possible" alive? It seems that Cassirer's goal was to reject metaphysical claims concerning the independent existence of objects and focus on the logical aspect of the way we construct objects. Cassirer shared the Kantian view of the priority of principles over things. This requires the idea of order as an indispensable assumption in every discussion of object. It considers the object as a whole, organized and systematically structured. Cassirer pointed out the concern now is given to the cognitive processes of the mind and showing the creative nature of the thought. According to Cassirer, one needs to discharge the concept of order from its ontological contents and at the same time to give it a logical function. The functional-relational thought, according to Cassirer, does not disregard the particulars or go beyond them but it tries to find a unitary whole to organize them in respect to a constructive law:

The genuine concept does not disregard the peculiarities and particularities, which it holds under it, but seeks to show the necessity of the occurrence and connection of just such particularities. What it gives is a universal rule for the connection of the particularities themselves...We do not isolate any abstract part whatever from the manifolds before us, but we create for its members a definite relation by thinking of them as bound together by an inclusive law. (Cassirer, 1953; 19-20).

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The question is no longer directed toward the nature of the object as a thing in itself, but toward the possibility of a relation to an object.... The objects themselves, however, have ceased to be concrete things and have become purely relational forms. (Cassirer 1957, 351).

Cassirer claimed that misunderstanding of the nature of the concept of object led it to be developed in the circle of ontology alone. This misunderstanding lies in *hic et nunc* which means that object has to be developed with reference to its local determinations. It also refers to the fact that the object derives its meaning and function from a concrete intuitive situation. Cassirer applied that view to all sciences seeking to give unitary and systematic forms to their contents. For example, Biology aims to arrange and classify the flux of the living world into a few categories where these beings can be ordered. Therefore it was necessary for biologists when they classify these beings to understand the concept of nature not as given or *hic et nunc* but as structured under certain rules. Therefore nature ceases to be a mere aggregation and sum of various and independent living entities, but instead becomes a system that gives a certain order to living objects. (Cassirer, 1950: 121).

Cassirer took the notion of form from its ontology and re-set it in the circle of logic. As a result, all the objects of science, according to that understanding, are forms of relational arrangements of particulars that are comprehensible only under these forms or structures that arrange them. It is claimed by Cassirer that all objects whether in the field of mathematics, physics, biology or chemistry have the same systematic and constructive nature. Although the laws and relations are different, it seems clear that the construction of objects has the same general foundation on which their contents organized and their inner unity is flourished:

The logical world, the mathematical world, and the world of empirical objects: all have a common foundation insofar as they are all rooted in one and the same primal stratum of pure relational forms. Without these forms, without categorical determinations such as unity and otherness, identity and difference, it would be equally impossible to conceive of a totality of logical objects, an aggregate of mathematical objects, or an order of empirical objects.... this new mode proves to be the indispensable preparation and presupposition for the achievement of an order in the world of perception and hence of that object which we call the object of "nature". (Cassirer, 1957:384).

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Cassirer was occupied during his discussion of perception by the question of how we construct objects in different perceptual situations. It will be argued that the impetus for Cassirer to critically discuss the nature of perception was his awareness of the recent developments in the field of geometry. Cassirer claimed that the process in which we construct geometrical figures and the possibility of transformation from one figure to another, can also be applied to perception and the objects we perceive in different perceptual situations can also be constructed similarly as the geometrical figures constructed. Cassirer built up his argument concerning perception on the grounds of the epistemology of geometry. Cassirer chose the German mathematician Felix Klein, who made a significant contribution in geometry. Cassirer regarded Felix Klein's "Erlanger Programm" as a paradigm for him to build up his account of perception. As a result, the next section will discuss the main features of Felix Klein's project and its effect on Cassirer epistemology.

4-4 Felix Klein's Epistemology of Geometry

Felix Klein (1868-1925) is a German mathematician who left a unique imprint on the history of mathematical development during the second half of the nineteenth century and the early twentieth century. Klein was concerned to defend the role of intuition of mathematics. He indicated that geometric intuition is essential to its development. Klein ascribed himself as an intuitionist. In his lecture delivered in 1893, Klein indicated that among mathematicians, one can distinguish between three main categories, logicians, formalists and intuitionists. Klein described logicians as those men belonging to this class who emphasized their logical and critical power, their ability to give strict definitions, and their ability to derive deductions therefrom. For formalists, they excel mainly in the skilful formal treatment of a given question and in devising for it an algorithm. Finally the intuitionists, Klein pointed out that they are those who lay particular stress on geometrical

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intuition not only in pure geometry, but also in all branches of mathematics. Klein ascribed himself as a logician and intuitionist. (Klein, 1893: quoted from Ewald, 1996: 957-958).

Although he was an intuitionist, Klein distinguished between two kinds of intuition; naïve intuition and refined intuition. He rejected naïve intuition, but he supported refined intuition. He stated in his sixth Evanston Colloquium lecture delivered in 1893:

I must say that, in my opinion, the root of the matter lies in the fact that the naïve intuition is not exact, while the refined intuition is not properly intuition at all, but arises through the logical development from axioms considered as perfectly exact. (Klein, 1893: quoted from Ewald, 1996: 959).

Klein sought to make the distinction between exact and naïve intuition clearer by giving details about the accurate difference between them. When he referred to naïve intuition, he meant that when we think of something we do not think of it abstractly but as something concrete. He gave an example of a point; he explained that according to naïve intuition, a point is a thing which is concrete. Naïve intuition fails to consider it as an abstract point:

In our naïve intuition, when thinking of a point we do not picture to our mind an abstract mathematical point, but substitute something concrete for it. In meaning a line, we do not picture to ourselves 'length without breadth' but a *strip* of a certain width. (Klein, 1893: quoted from Ewald, 1996:959).

Although Klein objected to the idea of using naïve intuition as a way of recognizing mathematical definitions, he maintained that in daily life we actually operate such in inexact definitions. We speak in daily life about the direction and curvature of a river or a road, although the line in this case has certainly considerable width.

The second kind of intuition is what Klein calls "refined intuition", this intuition arises through the logical development from axioms considered as perfectly exact. We can find refined intuition in Euclid. He developed his system on the basis of well formulated axioms. Euclid was fully conscious of the necessity of exact proofs. Here the conclusions derived by purely logical reasoning from exact definitions can no more be verified by intuition. He gave some examples showing that geometrical configurations can be deduced by purely logical reasoning, although imagination could not even draw a picture of these configurations. To explain this idea, Klein selected an example from the theory of automorphic functions:

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Let any number of non-intersecting circles 1, 2, 3, 4,..., be given, and let every circle be reflected (i.e. transformed by inversion, or reciprocal radii vectores) upon every other circle; then repeat this operation again and again, and *infinitum*. The question is, what will be the configuration formed by the totality of all the circles, and in particular what will be the position of the limiting points. There is no difficulty in answering these questions by purely reasoning; but the imagination seems to fail utterly when we try to form a mental image of the result. (Klein, 1893: quoted from Ewald, 1996: 960).

Klein disagreed with Pasche who believed that the whole science can be based on the axioms alone without need to resort to intuition. However, Klein confirmed that it is important for the purpose of research to combine intuition with the axioms. Klein indicated that intuition was the starting point of the development of science and the logical treatment followed intuition. Klein calls the process by which we give mathematical formulation to nature, “idealization”. He considered that logical investigation is not in place until intuition has completed the task of idealization (Klein, 1893: 970).

The process of idealization is understood here as a way to give an invariant form to the given. Although he concerned with intuition in mathematics, Klein paid attention to capture the geometrical properties of figures that unaffected by our accidental experience. What constructs geometry as a system is not these accidental characteristics, but these invariant characteristics that remain unchanged during the transformation. He proved using geometrical analysis that our actual space has different possibilities that may correspond to any one of these possibilities. The importance of this view is to show that actual space can be formed and ordered alternatively in the light of the geometrical system and its axioms which the geometrician adopts. Klein indicated that the forms which we ascribe to the given as a process of idealization does not mean that these forms geometrical demonstrations have absolute objective truth, but are true only for the present state of our knowledge. From this understanding, Klein will base his view of group as we will explain later.

In his paper 1893, Klein summarizes his theoretical view of the importance of intuition to logical investigation as follows:

To return to theoretical considerations, the general views which I uphold in regard to the present problems of mathematical science need scarcely be specifically formulated. While I desire in every case

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the fullest logical working out of the material, yet I demand at the same time an intuitive grasp and investigation of the subject from all sides. Mathematical developments originating in intuition must not be considered actual constituents of the science till they have been brought into a strictly logical form. Conversely, the mere abstract statement of logical relations cannot satisfy us until the extent of their application to every branch of intuition is vividly set forth, and we recognize the manifold connections of the logical scheme depending on the branch we have chosen, to the other divisions of our knowledge. (Klein, 1893: quoted from Ewald, 1996:971).

Cassirer refers here to the importance of intuition for Klein and the role it played in Klein's epistemology of geometry.

We often fall right back into the line of philosophy that has long been known as nominalism, where interest is entirely lost in things themselves and in their properties, and the only discussion is about what we shall call them and according to what logical scheme we shall operate with these terms.... I myself do not share this view at all, holding it to be the death of all science: The axioms of geometry are, as I believe, not arbitrary but rational propositions that in general are occasioned by the perception of space and are regulated as to their individual content by their suitability. (Klein, 1925: 202 from Cassirer, 1950: 43).

In his XI lecturer titled "*The Most Recent Researches in Non-Euclidean Geometry*" delivered in 1893, Klein indicated that there are three points of view from which non-Euclidean geometry has been considered. The first point of view is the view of elementary geometry of which Lobachevsky and Bolyai themselves are representatives. Both built up a system of non-Euclidean geometry in which the length of the line is infinite and the "measure of curvature" is negative. The second view is projective geometry. We begin here by establishing the system of projective geometry in the sense of von Staudt, introducing projective co-ordinates, so that straight lines and planes are given by linear equations. Also there is Cayley's theory of projective measurement which leads to three possible cases of non-Euclidean geometry.

Finally there is Riemann' and Helmholtz' views. Riemann introduced the notion of the measure of curvature of space. When Riemann attributed to his space of three dimensions a measure of curvature k he only wants to say that there exists an invariant of certain form. He does not mean to imply that the three- dimensional space necessarily exists as a curved space in a space of four dimensions. (Klein, 1911: 85-86).

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Klein considered that the second view has some advantage in adopting it although the third view is at least equally important.

The importance of Klein's thought emerged from his ability to develop a new methodological approach to investigating geometrical problems.

Klein investigated how geometrical figures can acquire different spatial properties through different processes of transformations. In 1895 Klein gave a lecture called "*The Arithmetizing Of Mathematics*", delivered at a public meeting of the Royal Academy of Science of Gottingen. In the lecturer Klein argued that geometrical properties of any figures have to be describable in terms of formulae that do not change when the system of coordinates is changed. The formulae will be invariant with respect to the group of given transformation and it represents a geometrical property. (Klein, 1872: from Cassirer, 1944:6).

Therefore the geometrical properties of any figure depend on general orders and rules not on the individuality of geometrical figures. These orders should be understood here as the schemes of arithmetic considered as the rules that form the main characteristics of geometry. Klein developed this idea understanding not to investigate directly the absolute reality of things, instead, he investigated and compared the geometrical form of knowledge with the logical forms. Klein indicates that mathematics is a science of logical forms where the numbers and the elements of any group are relatively joined or related within these forms. (Resnik, 1981:536-537).

Klein emphasized that the importance of mathematics lies in the logical forms that order geometrical properties. This belief led Klein to develop the idea of group which reflected clearly his epistemology of geometry. The question now is, why Cassirer paid attention to Klein's view of geometry and what was the significance of that in Cassirer's view on perception particularly? The answer can be shown in Cassirer's analysis of the knowledge. He found that Klein's view supports his view of Functional-Relational thought where the priority is given to relations over the contents. From other hand, Cassirer considered the notion of "group" provides good background to structuralism that will be fully developed in 1939 when he wrote his French article on group theory and perception.

Cassirer indicates that Klein's aim in Erlanger Program, was to confirm that properties attributed to figures are constructed and hence transformable not independent.

In 1872 the so called "Erlanger Program" of Felix Klein appeared. Under the title *Comparative Reflections on the More Modern Geometrical Investigations* and offering for the first time a comprehensive survey of the various possible geometries from a rigorously uniform and systematized

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standpoint, it was a highly significant advance not only in a mathematical sense but also as a critique of knowledge. Now at least the problem could be assigned its own rightful place. Klein restricted himself to its formal and analytical clarification, expressly avoiding all ontological opinions on the reality of space.... Klein shows that this science has to do solely with relations, which must on no account be confused with existence. He confines the discussion strictly to the field of mathematics, forbidding all excursions into the ontological and metaphysical. (Cassirer, 1950: 28-29).

Klein's understanding can be summarized under the concept of the group and the possibilities of transformation from one geometrical system to another system. Let us discuss the concept of group and its logical importance.

4-4-1 "the Erlanger Programm" and the Concept of Group

Klein applied the concept of group to different areas of mathematics, especially to Non – Euclidean geometries. The challenge for Klein was to understand the bases of these geometrical systems. Therefore Klein formulated his main question; how could every geometrical system be a theory of invariant that is valid in reference to definite groups of transformation?

Klein sought to provide the mathematical community with an answer in a speech he delivered at the University of Erlangen in 1872. According to Klein, only properties that are characterized by invariance with respect to certain transformations can be called geometrical. It is an inquiry into all properties of spatial figures that remain invariant throughout transformations. Such properties are independent of the position occupied in space by the figure under investigation and the order in which the parts are arranged.

"Given a manifold, and in it a transformation group; one should investigate the figures belonging to the manifold with a view to finding the properties that are not changed by the transformations of the group". (Klein,1929: from Cassirer, 1950: 31).

What does the concept of group mean? It seems clear that there are two meanings implied in the concept of group: a mathematical meaning and an epistemological meaning. The mathematical meaning of group will be addressed first and I will discuss later the epistemological meaning of group.

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Klein gave a definition to the concept of group where he reflected the general characteristics that should be included in every group. He indicates that:

The group is defined as a set of well-defined operations A, B, C, \dots such that any two operations A, B combined yield an operation that is a member of the unit; as a complementary condition it is required that besides A the reciprocal element A^{-1} be present in the group. (Klein, 1926: 335 From Cassirer, 1923: 30).

the definition of group is a set of elements plus an operation. A group usually implies different characteristics that can be summarized as follows; identical, inverse and associative elements (Stillwell, 1989: 275).

A group G must obey the following axioms:

1- Identity element: there exists an element e in G such that $ae = ea = a$ for every a in G .

2-Inverse: For each a in G , there exists an element a^{-1} in G (the inverse of a) such that $aa^{-1} = a^{-1}a = e$

3- Associative law: For any a, b, c in G , we have $(ab)c = a(bc)$.

For instance, the set Z of integers is a group under addition. The identity element is 0 , and $-a$ is the additive inverse of a in Z , G is infinite group, Z belongs to G .

Identity element then is $a+0 = a$

Inverse element is $a-a=0$

Associative element is $(a+b)+c=a+(b+c)$.

Klein studied the elements of the multiplicity with regard to those operations that are not affected by the transformations of the group.

Klein's definition of group refers to the possibility of combining the elements of the group according to certain operations. There is a logical possibility to have various orders of elements in one group in respect to different operations applied to the group. The impact of group theory is that it questions not the elements or figures as they have actual existence but rather their relations to one another under one system. In every operation, we have what we call a product that describes that operation and at the same time is the fruit of the combinations of the members of the set (Burns, 1977: 21 & Lyndon, 1985: 5).

Klein indicated that the characteristic properties of a multiplicity must not be defined in terms of the elements of which the multiplicity is composed, but only in the terms of the

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group to which the multiplicity is related. Therefore Klein's view was to prove that the characteristics of any figure are defined in terms of certain operations.

Klein's approach was to find possible interconnections between various geometries and he suggested that there are interesting points to be made in both geometry and group theory. Klein studied all geometry as a group of transformations and to separate geometrical systems in regard to its level of abstraction. He separated the geometrical systems the same way a chemist isolates the constituents of a chemical compound.

The gradual separation of affine and projective geometry from metric," says Klein. "may be compared with the procedure of the chemist, who isolates increasingly valuable constituents from a compound by using constantly stronger analytical reagents; our reagents are first affine and then projective transformation. (Klein, II From Cassirer, 1950: 34).

Klein shows that the concepts of modern geometry derive their precision and true universality only from the fact that geometrical figures are not considered as pre-given and rigid but as flexible structures that can be moulded into varied forms.

Another interesting idea raised by Klein's *Programm*, was the idea of invariance. We are not concerned with the mathematical meaning of the invariance that refers to the notion of unchangeable feature that remains unchanged during the transformations, but with the epistemological meaning of the concept of invariance that refers to the difficulty of having a permanent form of the set of the group. Klein studied geometrical configurations that remain the same through continuous transformations. In addition, Klein was interested in investigating the essence of the geometrical properties of the figures, and asking how the geometrical figures can change their characteristics in respect of different transformations. According to Klein, every geometry should be conceived of as a theory of invariants of a particular transformation group. (Bell, 1958: 145).

Klein claimed that all the non-Euclidean geometries are mathematically equal in respect to group theory. The truth of geometrical system no longer depends on the existence of things, but on the structure of axioms and presuppositions. As a result Klein argued that there are

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not independent characteristics of either geometrical systems or figures since we can transform any of these figures into another by group theory.

Projective geometry developed only when one begun to consider the original form and all those forms resulting from the latter by projection as essentially identical and formulate the properties transferred by projection so as to make appear their independence from the alteration connected with projection.

(Klein, From Cassirer, 1944: 7).

Cassirer agreed with Klein and gave more explanations to indicate the characteristics of a figure will be represented differently when it is transformed from one geometrical system to another as follows:

Thus, what in the geometrical sense must be taken as “identical” and what as “different” is by no means predetermined at the outset. On the contrary, it is decided by the nature of the geometrical investigation, viz., the choice of a determinate group of transformations. From the standpoint of metrical Euclidean geometry, e.g., the different conics appear as distinct entities, as independent geometrical individualities which have definite and well- defined properties. This distinction disappears when the point of view is changed. If we allow for the so-called “affinitive transformation” we can no longer maintain the distinction between ‘circle” and “ellipse” in the traditional sense, since by affinitive transformation circles are transformed into ellipses. This development is carried still farther in projective geometry in which quite generally an ellipse may be transformed into a parabola or a hyperbola, such that, in the final analysis, there is but one single conic. (Cassirer, 1944: 8).

Let us examine now the above-mentioned claim by giving an example from conic sections. The circle, the ellipse, the parabola, the hyperbola and two straight lines, are collectively known as conic sections. The reason for this is clear when considering a double cone (obtained by rotating a straight line through one revolution about an axis that intersects the line at an angle α say). When a plane cuts this double cone, the shape of the section formed depends upon the inclination θ of the plane to the axis.

If $\theta = \frac{\pi}{2}$, the plane cuts only one half of the double cone and the cross section is a circle.

If $\alpha < \theta < \frac{\pi}{2}$, the plane again cuts only one half of the cone and the cross section is an ellipse.

If $\theta = \alpha$, the plane is parallel to a generator of the cone and hence cuts only one half of the double cone in a sections which is open –ended. This section is a parabola.

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If $\theta < \alpha$, the plane cuts into both halves of the double cone, producing (unless the passes through the vertex) a section comprising two open – ended curves. This section is called a hyperbola.

If $\theta < \alpha$ and the plane does pass through the vertex, the section is a pair of straight lines.

If we consider the circle defined by its radius ($X^2 + Y^2 = 1$), this equation leads to a circle that has specific characteristics as it is shown in the figure (4-1). At the same time, a circle can be transformed into an ellipse if we change the value of Y to be 3 and the value of X is

invariant to be $X^2 + \left(\frac{Y}{3}\right)^2 = 1$ then the co-ordinations will be changed and will have different spatial co-ordinations and will have a figure of ellipse, as it is shown in figure (4-2)

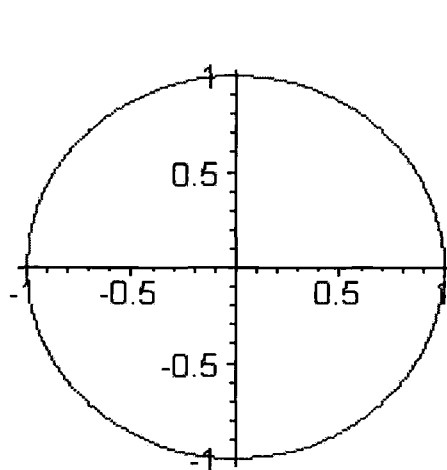


Figure 4-1 a circle

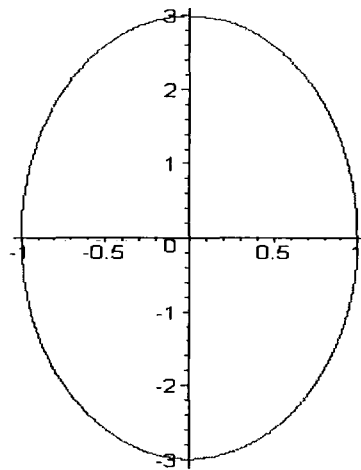


Figure 4-2 for an ellipse

Again, we can also see that an ellipse can be transformed into hyperbola if we change

+ p^2 to $- p^2$ In this case, the equation can be replaced to give $\frac{X^2}{a^2} - \frac{Y^2}{p^2} = 1$ Another

example is as follows. If we have a figure its points are the following; (3,1),(3,3),(6,3),(6,1) then if we want to see the images of these points under the transformation $\begin{Bmatrix} 1 & 0 \end{Bmatrix}$

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$\{-2 \ 1 \}$

In figure (4-3) A,B,C,D are the given points and figure(4-4) A', B', C', D' are their images under the transformation. When we compare ABCD, with its image A'B'C'D', we see that not only is the shape of ABCD distorted and rotated under the transformation, it is also turned over. We can see that the transformation is a shear in the direction of the negative Y-axis. We can also see that the geometrical properties of the figure are changed under the transformation.

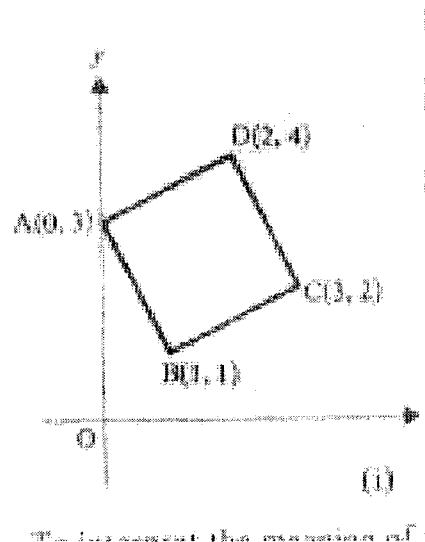


Figure (4-3)

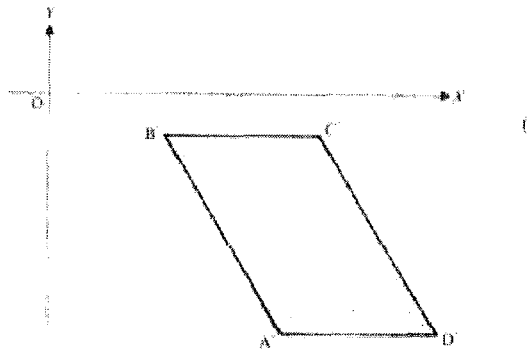


Figure (4-4)

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It can also be sketched that transformations can take place from two-dimension into three-dimension. For example, a circle ($X^2 + Y^2 = 1$), as represents a figure in two-dimensional space. However that circle can represent a figure in three- dimensional space if X^2 and Y^2 are constants and we added the factor H where H represents the height. In this case a circle will be represented as part of another geometrical figure that is a cylinder. In this case, ($X^2 + Y^2 = 1$), became according to the changes in perspective ($X^2 + Y^2 = 1$), where $Z=h$. Thus, H represents the height of the cylinder and Z represents the radius of the cylinder. According to that understanding, a circle can be represented as a part of another geometrical figure that is a cylinder when we change the operations under which the figures are underlined. Therefore we can always change the properties of geometrical figures by changing the function that will lead to changes in the figures and their characteristics.

Cassirer made use of Klein's view of group and extended its view to include different areas of knowledge. For Cassirer, the significance of group theory for the theory of knowledge was to stress that the characteristics of an object are not independent and are given permanently, rather they are acquired in respect of logical orders that are invariant. The characteristics of geometrical figures neither represent physical properties nor eternal characteristics, but relative characteristics ordered in respect to invariant

The pure concept does not lose itself in the flux of appearance; it tends from "becoming" toward "being," from dynamics toward statics. In this achievement philosophers have ever seen the genuine meaning and value of geometry. When Plato regards geometry as the prerequisite to philosophical knowledge, it is because geometry alone renders accessible the realm of things eternal. Can there be degrees or levels of objective knowledge in the realm of eternal being, or does not rather knowledge attain here an absolute maximum? Ancient geometry cannot but answer in the affirmative to this question.... But modern group theory thinking has brought about a remarkable change in this matter. (Cassirer, 1944: 29).

From the epistemological point of view, mathematics has to be seen as a system of objects fulfilling certain structural relations among themselves in relation to other systems, without regard to the particular nature of the objects themselves.

This is the epistemological meaning of group theory, as Cassirer understood it, it deals with the possibility of forming different structures that can order and organize the flux of the

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elements. It deals with the systems and structures upon which we can set up the objectivity of both physics and psychology as it will be explained in Chapter Eight. Objectivity can be established when importance is given to these constant elements on which our judgments are based. Cassirer attempted to apply that general understanding of group theory to different domains of physics, psychology and language where the meaning of objectivity will be established (Stump, 1999: 643-644). If the notion of group is a structural form, then the question now is to what extent could Cassirer develop Klein's geometrical view to be applicable to exact and human sciences?

4-5 Cassirer and the Structural Concept of the Object

We are now going to discuss Cassirer's analysis of the structural nature of the objects of sciences. It will be argued that Cassirer applied the general understanding of Klein's *Erlanger Programm* to different fields of knowledge. Cassirer believed in the priority of laws and orders over the elements and particulars. Therefore Cassirer applied the ideas developed by Klein in program to his paper *The Concept of Group and the Theory of Perception*:

The real foundation of mathematical certainty lies no longer in the elements from which mathematics starts but in the Rule by which the elements are related to each other and reduced to a "unity of thought" .(Cassirer, 1944: 8).

Cassirer showed in 1944 paper and 1942 *The Influence of Language Upon The Development of Scientific Thought* that there was possibility of applying the concept of group to both language and perception. He sought to apply what was discussed in Klein's Programm to other fields of knowledge. We claim that Cassirer could achieve that application by setting up his invariant theory of experience. Cassirer developed what he called "*the invariant theory of experience*" as a general approach to meeting our experience.

The final "invariants" are not given, they must be *searched* out, and "established." Yet this "establishing" is never something "absolute," but rather depends upon the continuing course of science. The "invariants"

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shift “from place to place,” such as in the general theory of relativity. Hence, an “invariant” “framework” always remains. But this framework itself is not fixed, but can change. (Cassirer, 1996: 120).

We are going to investigate the impact of group theory, as structural view, on Cassirer and how its impacts extended to be applied to different areas of science. We chose Biology and physics as two examples of Cassirer's structural analysis to the objects of these sciences.

4-5-1 Group Theory and the Structural Conception of Biology

Cassirer gave importance to Biology and was concerned with finding a link between his philosophical themes and the development of Biology. We find there was a co- operation between Cassirer and some German Biologists like Johann Von Uexküll in 1920 who explained to Cassirer the developments of Biology. The most interesting point in Cassirer's discussion of the development of Biology was that he shed light on some terms like types, patterns, forms and wholeness. These ideas are used in a sense to show that the organism is no mere collection of parts, but a form of the whole is presupposed. These ideas of type served to advance this thesis. On Cassirer's view, biology is concerned with the possibility of classifying and bringing individual under certain forms, rather than with the diversity of individual beings. Cassirer's interest in biology returns back to his discussion of the classification of organism. The whole nature, according to Aristotle, was constructed in the light of genus and species, class and order, and every individual took its place in this whole scheme. Despite that view, Kant introduced a different view, where nature was submitted to the laws of our understanding. Kant considered nature as a whole and understood its objects in the light of this view.

Cassirer defended the view that nature has to be understood as a whole and individuals are parts of that whole. Therefore, Cassirer presented two examples of biologists who understood nature as a constructive process in which individuals are classified in respect to structural schemes. The real concern of biologists now is to find the principles and rules that allow them to fit the variety of beings into different types of classification. This can be confirmed when we look to the writings of the Biologists of the nineteenth century. For

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instance Georges Cuvier (1769-1832) indicated that the task of modern biology is studying the principles organizing the world of organic beings. Cuvier considered that animals were functional wholes, and would die if any part were to become modified. He defended the idea of the whole over the parts when he saw organism as integrated wholes, in which each part's form and function were integrated into the entire body. Therefore he developed the concept of "types" as a scientific category under which he could classify organic beings and investigate the relations that combine them:

We cannot answer the question of the nature and origin of life forms in their systematic relationships. We must always direct our gaze to the whole if we are to reach an understanding of particulars and individuals.... The organism is no mere collection of parts, for even in its separate parts we can find the forms of the whole. We can never understand the world of living beings if we are to lose ourselves in the contemplation of its variegated and multiform character, for in the absence of fixed outlines and guiding principles it has no conceivable pattern. (Cuvier, 1835: 6 quoted by Cassirer, 1950: 128-129).

According to Cuvier, all progress in biology was based on finding out the universal principles that give the individuals their forms. Cuvier's views of biology and zoology were to support the theme that we have to go beyond the realm of living beings and focus on the general categories or laws that constitute our knowledge about beings. This idea led him to the discovery in fossils that it may be possible to reconstruct an entire unknown animal from one bone. The reason that Cassirer mentioned Cuvier as an example of biologists was Cuvier's idea of types.

For Cassirer he found both "type" and "group" share the same application and meaning. In fact, we can notice here according to that understanding, that the general interest of biologists is finding out the structure or the type that arrange the relations between individual beings. He studied the regularity of natural forms and processes, and he produced a theory of the "correlation of parts" to explain the functional basis of living structures and processes.

Cuvier's system of types was no longer really concerned with single characteristics: it was their relationship one to the other that was for him the decisive and determining factor. The individuality of an organism is not to be expressed in terms of any one special property, but depends upon the correlation obtaining among all its parts (Cassirer, 1950: 131).

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Cuvier could reconstruct the remains of animals by sketching different forms where these remains can be fitted and give an approximate shape of the extinct animal. Cuvier indicated that between all the bodies of the same animal subordination such as knowledge of only one body, one can deduce that from all the others: it is what it called the law of the correlation of the forms. By that law, it could create a new world because it managed to rebuild these beings of which there remains hardly some formless remains and classified them methodically. To classify these remains, Cuvier needed to have patterns in the light of them, the parts can be ordered and combined together. Cuvier's notion of type served as a structural possible order that is apriori and under which the parts can be combined.

Cassirer brought Cuvier's idea of type in this context to show that the natural world can be constructed in respect of structural orders that organize the relationship between the individuals. In addition, Cassirer also pointed that Cuvier was against naïve realism because his notion of type is not concerned with the properties of the organism, but with its form. The link between group theory and Cuvier's idea of type lies in the fact that both of them are structural forms of arrangement of the elements of the group or class. These two notions; "group" and "type" are a view of constructing the objects and a way of arranging the particulars in the light of general orders.

Systematic biology, therefore, as understood and practiced by Cuvier, was no mere device of classification and arrangement that can be easily apprehended, but a disclosure of the very framework of nature itself. Hence follows Cuvier's claim to the objective validity of his concept of the type. Certainly he was not caught in any naïve realism, for he did not treat the type as though it were a sensibility distinct thing. Its validity and truth lay in its indispensability as a principle of classification, and here Cuvier had chiefly and exclusively in mind the position in the scale of existence. Type had to do only with being: the causal order, the order of happening was outside his purview. The relations which he recognized were pure relations of contiguity, not of sequence, and the laws to which they led were not laws of succession but of coexistence. (Cassirer, 1950:131-132).

Cassirer refers to Cuvier's *Investigation on Fossil Bones* (1912) and confirms that biology is no longer concerned with properties of the animals but with structure. Although Cuvier was against the idea of evolution raised by Jean Baptiste Lamarck (1744-1829) Lamarck proposed a theory of evolution in *Zoological Philosophy* (1809) which states that animals

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acquired useful characteristics during their lifetimes which they then pass on to their offspring. Cuvier helped to lead others to modern ideas about extinction while himself denying gradual change within organisms. He was involved in famous debates with Lamarck over the relationship between extinction and morphological change. Although he was supporting the idea of "type constancy" against evolution, Cassirer defends his situation by claiming that Cuvier's idea of "type constancy" does not defend the things and their fixed properties but he chose it for a methodological purpose.

Even the animal world of a past epoch was never connected with our present world by any actual relationship but was of a wholly different type. The desire to arrange all forms of life in one single, ascending series Cuvier regarded as pure fantasy. To do justice to his theory historically it is necessary to remember that in his contest with the first defenders of the theory of evolution he took his stand not upon dogmatic but upon methodological grounds. He defended the "constancy of types" not as an ontological or theological dogma but as a methodological principle (Cassirer, 1950: 133).

Cassirer tried to justify Cuvier's view against evolution but still his total account brings him to structuralism.

Johann Von Uexküll (1864-1944) presented another example to show that the internal life of organism reflects the importance of structure for organism as presented by Cassirer.

The science of living beings, he wrote, is a purely natural science and has but one goal: investigation of the structure of organisms, their origin, and their functioning (Uexküll, 1930: quoted from Cassirer, 1950:199).

Uexküll's work was devoted to the problem of how living beings subjectively perceive their environment and how this perception determines their behaviour. Picture, for example, a meadow as seen through the compound eyes of a fly, continually flying through the air, and then as seen in black and white by a dog (with its highly efficient sense of smell), and then again from the point of view of a human. Von Uexküll called these subjective worlds *Umwelt*. The idea of *Umwelt* played an important role in Uexküll's view of individual behaviour. *Umwelt* means "environment" or "surrounding world". The term is usually translated as "subjective universe". Uexküll explained that organisms can have different

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Umwelts, even though they share the same environment. An organism creates its own Umwelt when it interacts with the world, and at the same time the organism reshapes it. He indicated that the form that we ascribe to an animal or plant is not a material thing but the form can be grasped and developed conceptually.

Structure is not a material thing: it is the unity of immaterial relationships among the parts of an animal body. Just as plane geometry is the science not of the material triangles drawn on blackboard with chalk but of the immaterial relationships the three angles and three sides of a closed figure... so biology treats of the immaterial relationships of material parts united in a body so as to reconstitute the structure in imagination (Uexküll, 1930, quoted from Cassirer, 1950: 200).

The Umwelt theory states that the mind and the world are inseparable, because it is the mind that interprets the world for the organism. Consequently, the Umwelts of different organisms differ, which follows from the individuality and uniqueness of the history of every single organism. Umwelt also unites all the processes of an organism into a whole. Internally, an organism is the sum of its parts operating in functional circles and, to survive, all the parts must work together co-operatively.

Cassirer thought of the Umwelt as an organizational form and though it, the internal life of the organism will be ordered. Cassirer pointed out that Uexküll argued that when we explore the structure of an animal in its features, then the whole being and mode of existence of the animal is revealed. Cassirer stressed the idea that every behaviour of individuals is based on its own structure. The individuals can react and receive the impressions for which they are prepared to receive by their structures. Hence the behaviour of an animal implies an endless chain of functions that connect between the animal itself and its environment. Uexküll's idea of Umwelt stresses the inner structure that creates the environment by its own activity.

All nature, the earth, the heavens, the stars, yes, the very objects that surround us, and remain, as world factors, only those operations that exercise influence upon the animal in accordance with its own structure. When this relationship of the organic structure to the external factors is carefully examined, a new world wholly different from ours is seen to surround every animal and constitute *its* environment. (Cassirer, 1950: 202).

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Cuvier and Uexküll are two examples presented by Cassirer to show that in biology, concern is paid not to individuals but to the conceptual ideas which has the power to classify the individuals and bring them under one of the possible forms of arrangement. Both ideas of "type" and "umwelt" from one side and "group" from another side share the same understanding where they are structural concepts seek to organize its members and give them possible forms of arrangement. To this extent, no difference can be noticed between the application of group theory as way of arranging its members and type as a way of classifying its members. Both of them construct their object similarly. Let us examine that view as applied to physics and how it constructs its own object.

4-5-2 Group Theory and the Structural Conception of Physics

Cassirer showed that physics is not concerned with particular material objects but instead it is concerned with structures. Cassirer explained that view by stating:

The concern of the new physics of relativity is with structure, with the ordering of events, and not directly to the existent as the materiality real (Cassirer, 1957: 473).

Cassirer also tried to find the invariant structures in the field of physics. Cassirer showed that the way that modern theory of physics constructs its objects differs from classical physics where concern does not lie with the rigid properties of the physical objects, but in the laws in respect to objects are constructed. Cassirer represented physical objectivity as an example of how modern theory of physics constructs its objects. According to Cassirer, the physical objectivity is no longer based on the existence of the things but depends on the variety and the objective validity of relations themselves:

Here the substantial is completely transposed into the functional: true and definitive permanence is no longer imputed to an existence propagated in space and time but rather to those magnitudes and relations between magnitudes which provide the universal constants for the description of physical process. It is the invariance of such relations and not the existence of any particular entities, which forms the ultimate stratum of objectivity. (Cassirer, 1957: 473).

According to that understanding, physical objectivity cannot be comprehended according to the naïve view of the world which used to look at physical objects as representing

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something external having independent properties. However, Cassirer explained that modern physics looks to physical objects as being established and constructed by laws, distinguishing them from the sensuous reality. The physical world is no longer taken as a world of constant things which have a bundle of unchangeable properties. However, the physical world can be understood as a system or structure of events each of which are determined according to constructive laws. After being influenced by *Klein's program*, Cassirer was convinced that modern physics no longer referred directly to bodies but to the structures. This view can be realized when we compare the geometrical and physical points. For Cassirer, there is no difference between them because the physicist could free his mind from the presupposition, claiming that the physical point has its own existence independently from the relations that form that point. However every physicist should realize that the physical point could only be realized through the web or the system of relations that form it. For Cassirer, if the geometrical point is defined through a specific system of formal relations, then it can only be defined as a functional constituent related to a specific physical system, and must change when we change the physical reference or system:

Just as the geometrician selects for investigation those relations of a definite figure, which remain unchanged by certain transformations, so here the attempt is made to discover those universal elements of forms that persist through all changes in the particular material content of experience. (Cassirer, 1923: 168).

Karl Norbert Ihmig also claims that Cassirer understood modern physical theories in light of Klein's concept of invariant:

Cassirer picked up the idea of the formation of invariants, as applied by Felix Klein in the "Erlanger Programm" for the purpose of classifying geometries, and developed it further as a general epistemological method for ascertaining what defines the object of scientific knowledge as a whole. This idea proves to have played a decisive role in the definition of the concept of the object within mechanics.... The special theory of relativity deals with the objects that are invariant with regard to the Lorentz transformations, whereas the general theory of relativity shifts to transformations that can be described through any continuous and differentiable functions. (Ihmig, 1999: 527).

As a result, we can see that Cassirer was convinced that the physical objects are free from any connection to any definite system. However the physical objects are not constant and

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absolute entities but are constructed with respect to different systems of reference that are invariant under certain relations:

These constants are not to be sought in particular given things, which are selected as chosen systems of reference from all others, such systems are the sun was to Copernicus and as the fixed stars were for Galilei and Newton. No sort of things are truly invariant, but always only certain fundamental relations and functional dependencies retained in the symbolic language of our mathematics and physics, in certain equations. (Cassirer, 1923:379).

The physical judgment is no longer based on the aggregation of separated and observational events. However the physical judgement refers to mere symbolic signs and to understand the meaning of these signs we do not need to direct perception; we only need to know the relations of these signs within a certain system of reference. Physical theory does not use the language of perceptual experience but rather a symbolic language to explain both the macro and micro realms.

To sum up, physics as geometry constructs its objects in respect to structures that determine the characteristics attributed to the physical object. Cassirer realized that the tendency of modern physical theory is not to represent things and to describe physical events, but rather to deal with the structures and the formal contexts of events. Cassirer knew that physical theory does not deal with the existence of the materially real; physics unifies the events under different and various contexts and orders.

Cassirer indicated that the same approach can be traced in psychology. He presented his view on the structuralism in psychology based on Gestalt experiments on perception. This claim will be discussed in the next few chapters how the Gestaltists understood the facts of behaviour in the light of holistic orders and how Cassirer represented their works in the light of group theory.

4-5-3 Group Theory and the Structural Account of Perception

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Cassirer presented a new account of perception matched with his general theme of functional-Relational thought. Cassirer sought to interpret psychology as an invariant theory of experience. Cassirer claimed that mind involves structures aiming to arrange chaotic elements of perceptual world. Cassirer rejected the naïve view of perception and the Associationist's theories that described perception as an aggregation or a bundle of isolated impressions.

Cassirer supported the view that human beings can correspond alternatively and differently to the same physical stimulus. In the same perceptual situation, individuals can represent the same object differently when he changes his frame of reference which provides him with the order for arranging the elements of perceptual situation. Cassirer's argument was based on the Gestalt view that the object we perceive is not a simple aggregation of elements, but rather it is an order that draws the form of relationships between the elements. For example, in cartoons an object seems to be in motion although it is static and motionless. A grey object can be represented as black when we bring it close to a white object. In perception, a distinction must be drawn between what is physically perceived by eyes and what is phenomenologically represented. What is physically perceived refers to a retinal image which reflects the real objects as represented on the retina. While what is phenomenologically represented refers to possible characteristics that can be ascribed to the represented figure in the light of the dynamic processes taken place in the mind. The properties of the represented object represented phenomenologically are constructed, flexible, changeable related to the frame of reference in which the phenomenological image works. Cassirer, depended on the Gestalt psychology to make this distinction between retinal and phenomenological images more clearer. Cassirer claims that every perceptual process involves at least some fundamental structural elements. He argues that the genuine concept of perception does not disregard the peculiarities and particularities of the occurrence and connection of particularities however it gives an epistemological priority to the universal rules or orders that connect the particularities.

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In 1944 Cassirer indicated that perception is the study of those structures which organize perceptual experience. He depended on Klein's group theory to show the transformations take place in the perceptual situation when one changes his frame of reference. How did Cassirer set up his invariant theory of experience guided by Klein's ideas?

For Cassirer, the properties of a figure are determined in light of operations and in light of the transformations taking place, the same application is also applied to perception where the characteristics of an object are determined by the conditions of the perceptual situation and the frame of reference organizes the relationships between the parts of the situation. Cassirer claimed that perception must not be defined as a bundle of sensations or a simple aggregation of impressions. On the contrary, he agreed with Christian Von Ehrenfels (1859-1932) and the Gestalt theorists that perception is something more than separate sensory entities, it is something added by our thought; namely the quality of figuration.

For instance Ehrenfels's example of melody, Cassirer understood the form of melody is an invariant even though the material contents of experience changed using different pitches. Cassirer pointed to the example of the melody and an optical spatial figure to show that both of them imply an invariant element if they are presented in a different scale but in the same proportions still the figure remain approximately the same, exactly the same as in the case of melody as we explained. In this article Cassirer states that:

What we find in both cases are invariances with respect to variations undergone by the primitive elements out of which a form is constructed. The peculiar kind of "identity" that is attributed to apparently altogether heterogeneous figures in virtue of their being transformable into another by means of certain operations defining a group, is thus seen to exist also in the domain of perception. The identity permits us not only to single out elements but also to grasp "structures" in perception. To the mathematical concept of "transformability" there corresponds, in the domain of perception, the concept of "transposability". (Cassirer, 1944: 25).

Cassirer used the Gestalt's term transposability to refer to the element that remains invariant during the transformations that took place in perceptual situation. The reference to these elements that are invariant in the perceptual experience are leading points because a possible judgment of perception can be set up.

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We could see that the idea of group as a structural idea played with others a role to lead Cassirer to the view that the construction of the object of knowledge, biology, physics, geometry and psychology, depends on the forms and its capacity to bring unity and systematization to the individuals and the elements.

In the next chapter we will investigate the theoretical framework of the Gestalt school and show that the Gestaltists' views on psychology provides an example of the application of this structural view of constructing the objects of perception.

Gestalt Theory of Perception and Structuralism

5-1 Introduction

The aim of this chapter is to portray the structural account of the Gestalt theory of perception. It will try to focus on the structural properties presupposed in every perceptual experience and to examine some of the Gestalt experiments designed to explore the nature of perception. Therefore in order to understand the Gestalt structural account of perception, we will explain the structural features of perception and its laws. It will also discuss the perception of apparent movement and explain it in light of the general structural account of the Gestalt. I will also elucidate Cassirer's claim that perception can be based on the mathematical understanding of Group theory. The question now is what are the basic features of structuralism as displayed by The Gestaltists? Furthermore, how can we apply that structuralism to the perception of apparent movement?

5-2 The Gestalt Principle of Isomorphism

The Gestaltists explained the structural account of their psychology by using some different concepts from different exact sciences such as invariance, transformation and isomorphism. They applied the concept of isomorphism to their psychology as an attempt to explain the changes take place in the perceptual field by comparing it with the changes take place in the brain. In fact, many theorists, such as Muller, took the position that perceptual organization reflects innate properties of the brain itself. Indeed, perception and brain functions were held by Gestaltists to be formally identical (or isomorphic), so much so that to study perception is to study the brain. Therefore, according to the Gestaltists, isomorphism refers to a correspondence between a stimulus array and the brain state created by that stimulus. For example, in Max Wertheimer's (1880-1943) view on *Phi-Phenomenon*, as we shall explain it later in the present chapter, a pair of alternating and spatially separated patches of light create the illusion

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of motion, it is argued that the brain state created by this stimulus matches the brain state created by a patch of light moving between the two locations.

The Gestaltists among themselves had different views of the application of isomorphism, however, they agreed that there are structural similarities between the processes taking place in perception and those taking place in the brain as suggested by Wertheimer.

For Example, Kurt Koffka (1886-1941) mentioned the principle of isomorphism, "according to which characteristic aspects of the physiological processes are also characteristic aspects of the conscious processes." In addition, we could see a reference to the concept of isomorphism in some of Wolfgang Kohler's (1887-1967) literatures such as; *Gestalt psychology* 1930, and *Gestalt Psychology: an Introduction to New Concepts in Modern Psychology* 1947 where his studies of physical Gestalten culminated in the hypothesis of psychophysical isomorphism. Kohler claimed that there are correlations between our sensory perception and the functional processes of our brain. This meaning reflected in his definition of Isomorphism. He states that:

Isomorphism is the thesis that our experience and the processes which underlie these experiences have the same structure. (Kohler, 1947: 201).

The idea of Isomorphism played a role in the theoretical background of the Gestaltists' structuralism. In a section entitled "Relation Between Behavioural and Physiological Field Crucial," Koffka wrote about a conversation that took place between him and Wertheimer as follows:

This conversation remains in my memory as one of the crucial moments of my life. It happened at Frankfurt on the Main early in 1911. Wertheimer had just completed his experiments on the perception of motion phi phenomenon in which Kohler and I had served as the chief observers. Now he proposed to tell me the purpose of his experiments ... [O]n that afternoon he said something which impressed me more than anything else, and that was his idea about the function of a physiological theory in psychology, the relation between consciousness and the underlying physiological processes, or in our new terminology, between the behavioural and the physiological field. To state it in these new terms, however, is not quite fair, because this very statement was only made possible by Wertheimer's idea; before, nobody thought of a physiological or, for that matter, of a behavioural field. (Koffka, 1935: 53-54).

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Kohler claimed that there are similarities between both physiological and perceptual processes since they share the same structural functions performed. Katz shows this fact in his 1951 by stating that:

The essence of isomorphism is that phenomenologically ascertained forms actually correspond to psychophysically forms. Psychophysical forms in the brain are viewed as not essentially different from the physical forms of inorganic nature.... And if the forms of experience correspond to recognizable physical forms in the nervous system, a path is opened to the study of the brain processes concerned.... To prove the existence of forms in the inorganic world Kohler applied both of Ehrenfels' (1890) criteria for experienced forms. He maintained that they could be employed equally well in the case of physical forms. (Katz, 1951: 55).

The Gestaltists' view of psychology does not understand an individual's behavior to be the sum of accumulated responses to physical or external stimulus. Rather, they defend the view that psychology should study an individual's behaviour as a constructive process generated through spontaneous responses to the whole perceptual situation. The Gestaltists were not interested in explaining the individual's behaviour by restricting their views only on the view that sense organs respond to local stimuli with local impressions. On the contrary, they claim that the organism reacts as a whole to any given stimulus group. They were not interested in One to One correspondence between sense organ and stimuli, but with the correspondence between One to Many. Although it is one stimulus that hits our for instance, eyes, but the eye can respond variously and construct different forms of the same figure it perceives. This view will be explained when we distinguish between retinal and phenomenological image where the latter represents the figure perceived variously through a dynamic process of construction. The same dynamic process are implied similarly in physiological brain process. Kohler presented the following example to draw an analogy between perceptual process performed in the perceptual situation and the physiological processes in the brain:

I have before me three white dots on a black surface, on the middle of the field and the others in symmetrical positions on both sides of the former. This is also an order; but, instead of being of the merely logical kind, it is concrete and belongs to the very facts of experience. This order, too, we assume to depend upon physiological events in the brain. And our principle refers to the relation between concrete experienced order and the underlying physiological processes. When applied to the present example, the principle claims, first, that these processes are distributed in a certain order, and secondly, that this distribution is just as symmetrical in functional terms as the group of dots in visual terms. (Kohler, 1947: 61).

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In his 1950 book, *A History of Experimental Psychology*, Boring wrote about the phi phenomenon and isomorphism in Chapter 13, entitled "Gestalt Psychology." In 1912 Wertheimer was describing seen movement under the conditions of discrete displacement of the stimulus, as it occurs in the stroboscope or in the cinema. Boring indicated that the Gestaltists' goal was to show the object is dynamically constructed similar to the dynamic processes take place in the brain. Boring showed that understanding by stating that:

Because Gestalt psychology tends to deal with wholes it frequently finds itself concerned with fields and field theory. A field is a dynamic whole, a system in which an alteration of any part affects all the other parts Because perception seems often to follow laws of physical dynamics, Kohler has supposed that there are neural brain fields which underlie and account for the dynamics inherent in the phenomenon of perception. Koffka has supposed that you must understand human action in terms of a behavioural field which includes, not the stimuli and the physical environment, but the outer world and its objects as perceived and conceived by the actor. (Boring, 1950:591).

He also tried to show the importance of isomorphism to the Gestaltists as a way of interpreting the holistic and dynamic process involved in perception. Boring states in another paragraph as follows:

There is much more to be understood about Gestalt psychology than that it deals with wholes and phenomena. Usually it works in terms of field theory, as we have noted. The important Gestalt psychologists have accepted a special theory of relation between experienced phenomena and the underlying brain processes, the theory called isomorphism, and to that we shall return. (Boring, 1950: 591).

Kurt Lewin (1890-1947) made contributions to learning and a theory of social field. Lewin's concern was to display the analogy between psychological force and physical force by emphasizing that these two enterprises involve a dynamical construction as he explained in his analysis of behaviour in social situations.

Lewin used this analogy to build up his view of social psychology and to prove that social life space emerges from the tension between social forces in a social situation and implies the same dynamic construct as physical forces. This will be explained in Chapter Eight. There is a difference between Lewin and the rest of the Gestaltists in the terminology used in respect of the term forces: Lewin used psychological forces, while the Gestaltists used physiological forces. Lewin did not use isomorphism, but

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indicated that both psychological and physiological forces have the same structures and imply the same applications.

In case one should prefer to speak of “physiological” forces rather than psychological ones we would not mind such terminology, although it might be misleading. The reality of the psychological forces is the same as that of the biological forces governing the brain. (Lewin, 1938:87).

Lewin established his structural account of Field theory based on the fact that human behaviour has to be understood in respect to the total social situation which an individual passes through. For Lewin, the total social situation is the frame of reference of the individual, within which all his reactions and relations are constructed. Lewin drew this conclusion from a branch of mathematics called topology which deals with transformations in space. Lewin indicated that there is no reason to distinguish between the particle of physical material and social material because in the social as in the physical field implies structural properties of the dynamic whole. The principle of isomorphism was one of those principles used by the Gestaltists to point to the constructive dynamic processes involved in perception.

To sum up, the concept of Isomorphism has been applied by the Gestaltists in psychology. The Gestalt psychologists’ task was to find out the similarities between the functional processes of the nervous system and structural organization of perceptual situations. It was a challenge for them to bring out the processes of systematization, construction, unification and regularity that implied in our perceptual situations when we perceive the objects.

5-3 Gestalt and Structuralism of Perception

The Gestaltists wanted to reflect the holistic view of perception and evidence of that can be seen in the concepts they used to analyze the nature of perception. For example they used perceptual organization to show that the elements of any perceptual form are not randomly related to each other. But the parts of a perceptual form are related in respect of certain orders that arrange the relationship between them. They also used concepts such as transformation, transposition and structured units to show that perceptual forms are understood by the fact that forms are perceived as being a whole unit and its

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elements are grouped into the unit in certain orders. The Gestaltists indicated that phenomenological images understood as perceptual forms or structures and the elements composed of these units do not have to be independent. The phenomenological object and its elements do not have an unchanged order of display or representation but the phenomenological object will be decided in the light of orders of arrangement determined by the dynamic processes of transformation and rotation of the figures. In every perceptual experience, the perceptual forms will be decided in light of these dynamic processes as we shall explain.

According to this, the perceptual elements will be correlated and this means that perceptual forms are not necessarily identical in every perceptual experience, but rather they vary regarding the perceptual situation and the rules that determine the mode of arrangement. Therefore, according to the Gestaltists, phenomenological images vary and change during perception, from one person to another and for the same individual when the conditions determine the perceptual situation altered. The Gestaltists claim that the phenomenological images are changeable and transformable according to the organizational laws that determine the sort of correlations and relations between the elements of structure. It is important to mention the general features of the Gestalt school as applied to perception.

These features emerged from Kurt Koffka's objection to the answer of the following question: why do things look as they do? An immediate answer to that question might be "because things are what they are". Indeed, this form of answer to Koffka's question was originally formulated by Greek philosophers who proposed that our perceptions of the world were due to miniature copies (eidola) of the external objects as perceived by the sense organs. Koffka rejects the idea that perception is a mere translation of what exists in the external world, as represented by retinal image, and argued that perception implies elements are not involved in the external objects we perceive in the experience. They also rejected the claim that sensory fields are organized by innate cerebral mechanisms. On the contrary, they suggested another functional model that emphasized the operations and processes taking place in behaviour over the stimulus as we explained earlier.

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The Gestaltists believed that perception and knowledge come to be structured. (Gibson & Eleanor, 1955: 387).

What are these non- physical or structural elements characterizing the Gestalt account of perception? The answer has been given by the Gestalt psychologists who mentioned over a hundred laws that organize the perception experience. However, Allport F (1955) later counted these elements under six general elements and summarized them, as follows:

I- Form

The central idea of Gestalt theory of perception is the form. In fact, form is the main characteristic that distinguishes the percepts from structure. Form is the creation of the phenomenological image which contrasts the figure or the percept which is the product of the retinal image. Form generally resists alteration, it differs from the elements that are changeable, but form is that order of arrangement that set up between the constituents. In addition, form is not to be considered as a mere aggregate of simple parts since form implies a rule of order that remains invariant during the dynamic processes taking place in the perceptual situation.

II- Wholeness

It is a claim about the fact that perceptual field has to be taken into account as one whole. It is also mentioned that the individual life, his past, present and future has to be taken into one the whole. The Gestaltists use the term “whole” as synonymous with the term form. The difference between form and whole is that whole is more general and wider concept than form because it can, in addition to the perceptual situation, refer to the individual’s experience as one continuum or one whole and understands the events in the light of that experiential whole. However, the term “whole” is more used in accordance to the parts to show the logical priority of whole over the parts. Wholeness, as a characteristic attributed to perception, means there is a presupposed structural element organizing the relationships between constituents. Therefore, there is a close relationship between the whole and its parts in the sense that when the parts are less tightly bound together, the form quality of the whole tends to disappear and vice versa.

A clear example, when the relationships between the parts composing the perceptual situation are setting up close to each other, the chance of organizing these parts in a

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whole is more easier if the relationships between the parts are sufficiently apart from each other. Like in Kohler's experiment on Sultan the famous monkey as we shall discuss in Chapter Eight. Wholeness is as a quality that shows, by a dynamic process of mind, that parts are fitted in pre-constructive whole. Kohler considers that the dynamic process is the new turn that has to be methodologically taken into account when we discuss perception.

The Gestaltists ascribed a quality of holistic structuralism to perceptual experience instead of considering it as a simple aggregation of impressions and sensible elements.

III-Field and Forces

This concept comes from physics and the Gestaltists used it to explain the nature of perception. It was Lewin, among the Gestaltists, who promote; field and forces in his *The Conceptual Representation and The Measurement of Psychological Forces* 1938, and *Field Theory and Learning* 1942. Lewin and the other Gestaltists demonstrated their understanding of the concept of field when they presented their views on perception and human behaviour. In addition, Lewin was unique among them because he used the concept of force and re-used it in his social psychology to explain the human behaviour when there is a conflict of forces in social situations. Field is, by Lewin, considered as a medium that maintains equilibrium between conflicting forces in social situations. The behaviour of objects is determined by the structure of the *field* of which they are a part (Hartmann, 1935: 68).

IV- Transposition, Transformation and Flexibility

These three concepts refer to one fact and reflect the nature of the phenomenological object as the Gestaltists understood it. They show there is mental activity that leads to the re-organization of visual perceptual forms and brings new phenomenological objects out of the object represented by retinal image. The concept of transposition was raised by Ehrenfels when he published his observation on the transposition of tunes. Transposition means that the same structure or form can be realized by different elements e.g. major scale form realized by different sets of notes with different pitches, timbres. Ehrenfels explained that rhythmic structure is very important for the tune because we can still display the same rhythmic structure even using a different pitch. Perception of music is concerned with sensory forms, however the same understanding

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can be investigated in motor and visual forms. The same understanding can be applied to the concept of transformation, the Gestaltists call the changes that take place in our perceptual field and lead to changes in the phenomenological image as perceptual transformations. Transformation can be identified as changing the perceptual situation sufficiently brings about a change in form e.g. delay between light flashes increasing to >0.2 seconds. The Gestaltists explain and justify these changes that take place in the perceptual field by claiming that when the organizational field is changed a new order of arrangement is required and perceptual transformation will be recognized. These two concepts; transparency and transformation lead to the third characteristic that was flexibility. Flexibility means that the same elements can be arranged in different forms. They explained the fact that constituents of any phenomenological object are not fixed constituents or have independent properties rather they are transformable and flexible and can be re-formed when perceptual structure changes.

V- Bounding Features, Symmetry and Goodness of Form

The parts of the perceived configuration have bounding features that allow them to give a comprehensive form to the perceivers. The form as opposed to the ground tends to be simple, balanced and symmetrical compared to the ground. The characteristic of symmetry of form is a clear tendency toward the Goodness of form. According to the Gestaltists the term Good refers to characteristics such as; regularity, symmetry, harmony and unity. These properties must be included when we perceive visual forms.

VI-Organization

The concept of organization underlies the whole Gestalt view of perception. According to the Gestaltists, organization determines the relationship between the form and its parts. The field of organization is the true answer to Kohler's question of why things look as they do. His answer is based on his analysis of the organizational forms that order and organize things in the perceptual situations. The elements of any phenomenological object are grouped and organized according to the system of reference of the perceiver. The organizational field is presupposed in every perceptual experience and it is not an outcome of simple aggregations of these elements.

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These are the Non-Physical elements that show the structural account of the Gestaltists of perception. It seems that the Gestaltists would face difficulties regarding their explanations of perceptual experience, if they did not support the idea that reason has comprehensive orders of organization that have to be taken in account. This view raises the claim that there is a transcendental account of the Gestaltists involved in their view of perception. This transcendental view along with a systematic dynamic approach will be a distinctive view of the Gestaltists. The Gestaltists believe that there are some constructive or non- physical elements presupposed in perceptual experience that had to be understood in that context and not as a mere aggregation of elements. The Gestaltists present different examples to confirm that view. For example, we can trace their structuralism from Max Wertheimer's idea of the *phi-phenomenon* (the impression of apparent movement). Phi-phenomenon is that apparent movement produced by presenting two visual elements in two different locations, with a short time interval. If we take an example of Phi-Phenomenon such as the example discussed by Wertheimer, it reflects the Gestaltists' claim that perceptual experience implies something constructive, transcending the total sum of sensible impressions.

Consider a subject seated in a dark room. Two spots of light are flashed off and on alternately. When the interval between these two flashes is more than 0.2 seconds, the subject sees two separated flashing lights, but when the interval is less than 0.2 seconds, the light apparently moves, e.g. the character of the experience determined by the relation between the flashes. The subject will perceive, instead of two separate flashes, an object that seems to move from one position to another. In reality it is merely presented twice in two different places with an appropriate short time interval between both exposures. This experiment shows that an object is apparently moving despite the fact that the movement is not supposed as a separate element of the visual experience that includes only two separated flashes. These kinds of experiments on perception led the Gestaltists to argue that perceptual experience involves a structural element is not an outcome of simple aggregation of the sensible elements or the parts implied in the perceptual situation (Leahey, 1992: 197).

The Gestaltists applied this to different sorts of perceptual experience other than visual experience. David Katz applied the above-mentioned result to explain audio experience

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of rhythm. He indicated that it is impossible to capture a rhythm if the interval between metronome beats is separated by long intervals. However, if the intervals between metronome beats are short, then a subject will easily realize the rhythm. Katz went further in his analysis by explaining that if the metronome beats are at equal intervals but there are two loud beats consistently followed by two soft beats, then the soft beats will be grouped as sub rhythms under the total rhythmic structure.

If the subject hears a series of metronome beats separated by short intervals it is practically impossible to think of each beat as isolated. Two, or several, always combine to form a rhythmic series. The rhythmic effect becomes more distinct if all the beats are not presented at equal intervals, but in such a manner that two or three always follow each other with the same separation, and are separated from the next group by longer pause....If in a series of metronome beats at equal intervals two loud beats are consistently followed by two soft beats, the soft beats will be grouped and the same may be said for the loud ones. They will be heard as sub rhythms in the total rhythmic pattern. All rhythmic processes, whether they occur in music, dancing, or everyday colloquial speech, can be treated scientifically only if regarded from a holistic viewpoint. No rhythmic experience is explainable on an atomistic basis. (Katz, 1951: 34-35).

The Gestaltists emphasized from their experiments that the whole is greater than its constituents. The visual perceptual experience presupposed an organizational order that set up the relationships between the parts of the whole. The question now is what are the aspects of their structuralism? The aim of the following pages is to discuss these structural aspects of the Gestalt theory of perception. Therefore, I will start with the first structural aspect of their theory of perception.

5-3-1 Structuralism and Perceptual Organization:

It is important to define what is meant by perceptual organization. Perceptual organization is a psychological process that finds different ways for ordering and grouping detached elements in a perceptual situation by bringing them together under one form. For the Gestaltists the main concern was the structures that bring systematic arrangements between the constituents of the perceptual situation. Wertheimer claimed that we do not perceive objects as an accumulation of isolated sensations, rather we perceive them as organized wholes or as Gestalten:

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I stand at the window and see a house, trees, and sky. Now on theoretical grounds I could try to count and say: here these are....327 brightness and hues, do I have 327? No, I see sky, house, trees and no one can really have these 327 as such. (Wertheimer, 1958: 115).

Gestalt psychologists presented a new view that states that instead of reacting to the local stimulus, the organism responds generally to the pattern of stimuli where the parts of the pattern are organized in respect of specific orders or laws. In fact these laws are on application of a unitary process producing a functional whole that we acquire in the perceptual situation by *Insight*. The "whole" that we see is something that is more structured and cohesive than a group of separate particles. The question now is what are these functional laws of perceptual organization as discussed by the Gestaltists? In addition, how do these laws demonstrate the structural account of perception?

According to the Gestalt psychologists, there are over a hundred laws that organize perceptual experience. However, only the most famous laws that are most frequently mentioned in their literature will be discussed. These laws are the following:

1-Figure and Ground:-

The law of figure and ground is one of the most important laws that organizes our visual field. It is a law that states perception is organized into a figure and ground where the figure has to stand apart from its ground. The Gestaltists distinguished between figure and ground as a form that had previously been perceived as ground could function in a surprising way when experienced as a figure. For them, figure is simpler, more structured, and perceptually dominant part of the situation. The ground could be everything else, the surroundings apart from the figure perceived. The relation between ground and figure is always determined by the characteristics of reversibility where the form can be turned to be a ground and vice versa. How can a figure possibly be perceived as ground? Edger Rubin (1915-1958) a Danish Gestalt psychologist presented different experiments that aimed to find an answer to the question. In German, he expressed this as "wie der Grund gestaltist wird" *How the ground becomes structured* (Rubin, quoted from Beardslee& Wertheimer, 1958:194).

Edger Rubin helped to answer the question when he set up the first law of perceptual organization in which he distinguished between figure and form and draws the relation

between them. He illustrated the fact that a figure is perceived more as simpler than the ground and the figure usually lies upon the ground because it has a definite shape and is more dominant and more impressive than the ground (Maltin, 1988:156-157).

For the Gestaltists, the perception of structure was not only primary, it was basic: that (is even), the simplest percept is distinguished by the elementary discrimination of a structured figure from its unstructured ground. The major thrust of their work was to identify the laws of organization which determine what will be seen as figure and why. (Hagen, 1980:10).

Rubin gave some impressive examples showing the specific relationship between figure and ground. One of the most famous examples is the two faces and the vase. When you look at this image you might see either a pair of silhouette faces gazing at each other or an ornate vase. The vase appears white against a black ground, whereas the faces appear black against a white ground.



Figure (5-1)

How does the figure – ground law reflect the structuralism of visual perceptual forms? Structuralism can be understood as *the pure possibility of re-arrangements the contents of experience under holistic wholes that organize our perceptual fields*. It is the task which aims to explain the changes take place over the phenomenological image and explain these changes in the light of the dynamic processes such as reversibility, rotation and transformation. That explains how one goes beyond the figure given in the direct experience and represents and constructs it differently from the simple representation of the given figure. If structuralism will be understood in that sense, then I will try to examine that meaning through different forms of perceptual experience. Figure and ground, as a way of organizing the constituents of perceptual situation, is addressing that definition in that sense.

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It is impossible for a person to perceive two perceptual forms simultaneously. The reason is that two frame of references cannot be given at the same time. Only one phenomenological image is represented in the light of a frame of reference and when it is replaced by another one, a different phenomenological image will be represented. The dominant frame of reference determines the order of arranging the relationships between the constituents of the form.

2- The law of Proximity:

This law states that: the objects that are closest to each other tend to form groups. According to this law, one will see the arrangement of two sets of dots not as a set of rows but rather a set of columns. We tend to perceive items that are near each other as groups. In other words, objects or events that are near to one another (in space or time) are perceived as belonging together as a unit. The Gestaltists applied the physiological understanding of the facts of brain functions to the field of visual perception. They suggested two points of excitation in the brain produced by the stimulation of the retina by two points of light, set up fields. The end result is a force of attraction between the points of excitation, the closer the points are to each other; the stronger the force of attraction between them. The law of proximity is a reflection of that understanding. (Schiffman, 1996: 173-175).

3- The law of Similarity:

Similar objects tend to be grouped together and also items that are similar in some way tend to be grouped together. For example, when more than one kind of element is present, those which are similar tend to form groups. The difference between this law and the law of proximity is based on the fact that grouping of perceptual elements by similarity takes place in spite of the fact that the distances between unlike elements are equal to the distances between similar ones. Moreover, grouping may also occur when only certain parts of elements have a similar colour or form. It seems that the law of similarity is the simplest law among the gestalt organizational laws. Because this law concentrates on qualitative characteristics as a way of grouping and ignore the other characteristics that can be taken into account in classification and ordering the elements.

4- The law of Good Continuation:

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This law is also called “the law of good continuation” by Max Wertheimer. It states that there is an innate tendency to perceive a line as continuing its established direction. The perceptual elements of a form that appear to follow in the same direction, as in a straight line or simple curve, tend to be grouped together. For example, a straight line is a more stable structure than a broken one, and therefore organization will occur in such a way that a straight line will continue as a straight line. The unique feature of that law lies in the fact that it is used in the field of geometry and visual space. For example, if one sees two parallel straight lines and there is a straight line passing through them, then we tend to perceive that line as one continued straight line. This law indeed shows clearly that perceiving any perceptual form requires something greater than a mere accumulation of elements.

For example in figure (5-2) the perceptual figure breaks up into two different forms: a circle A and a rectangle B. although there is a part in the figure (1) is not apparent because of the rectangle hides that part, still we think of that figure as a circle. It is not the retinal image that lets us to perceive the figure as a circle. But there is another process that suggested by the Gestaltists that let us perceive this uncompleted figure as a completed form. Why do we perceive a good and continuous figure of a circle even though it is not represented by the retinal image? The answer lies in the fact that there is a non-physical element presupposed and ascribed to the experience of constructing our perceptual form. Without that structured element, we would not be able to interpret perception.

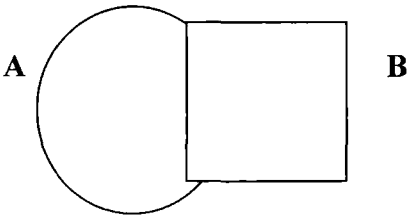


Figure (5-2)

5- The law of Closure:

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This law states that when a space is enclosed by a contour, it tends to be perceived as a figure. In other words, that there is an innate tendency to perceive incomplete objects as complete and to close or fill gaps and to perceive asymmetric stimuli as symmetric. When a circle has a missing part, although geometrically it is not a circle, our reason closes that missing part, and perceives it as a complete form of a circle. The same thought is applicable to three simple separated acute angles, where we arrange them in a certain order to be perceived as a triangle. The same question why do we perceive forms as completed and closed despite they are not? The same answer applies because of the constructive nature of reason.

6- The law of Pragnanz:

This law was introduced by Wertheimer, who called it the *law of Pragnanz*. The law of Pragnanz refers to the idea of “Good” in the sense that it can mean several things such as regular, orderly, simplistic, symmetrical, etc. The law of Pragnanz is sometimes referred to as the law of good figure or the law of simplicity. This law holds that objects in the environment are seen in a way that makes as simple as possible. The Gestaltists considered that reality is organized and reduced to the simplest form possible. Like the symbol of Olympic Games, we tend to perceive the five circles as simple circles rather than as many much more complicated shapes.

The most significant issue here is that the law of Pragnanz implies a systematic meaning that brings about to the objects presented by the phenomenological image. Koffka indicated those systematic meanings implied in the concept of Pragnanz when he presented his definition of Pragnanz. He explained that the idea of “good form” refers to characteristics such as regularity, symmetry, inclusiveness, unity, harmony, maximal, and simplicity (Koffka, 1935: 110).

The gestalt laws of perception emphasize the organizational relationship between perceptual elements and structural wholes. A gestalt as we could see, is a product of organization, and organization is the process that leads to a gestalt. The perceptual elements being parts of a structural whole, are ordered in light of internal rules of arrangement implied in the whole. Wertheimer expresses that fact when he admitted the organizational relation between parts and its whole:

What happens to a part of the whole, is determined by intrinsic laws inherent in this whole.

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(Koffka, 1935: 682).

The Gestalt laws of perceptual organization emphasize one important fact concerning perception: the logical priority of structures over the parts. This understanding shows the active role of reason in going beyond the information given in perception.

The laws of Gestalt psychology confirmed the belief that we perceive objects as structured coherent wholes rather than as their component parts.

The main theme of Gestalt research was a set of laws describing what types of perceptual structures are systematically evoked by particular types of patterns. (Roth & Frisby, 1986: 97).

The question is whether the organizational form of grouping the perceptual elements is absolute and permanently fixed or is it flexible and changeable? This question will be discussed in the next section.

5-3-2 Change of Perceptual Organization

The aim of this section is to explore the relative nature of perceptual forms represented by the phenomenological images as being one characteristic of the Gestalt structuralism. There are two points of departure that can clarify the specific nature of perceptual forms. These two points represent two approaches on which this argument depends. These two approaches are the following; the geometrical approach and the physiological approach. Before discussing these two approaches, I would like to present a diagram that explains, according to the Gestaltists, how phenomenological image is different from retinal image in representing the objects, and what are the dynamic processes of rotation and transformation are involved in constructing phenomenological image.

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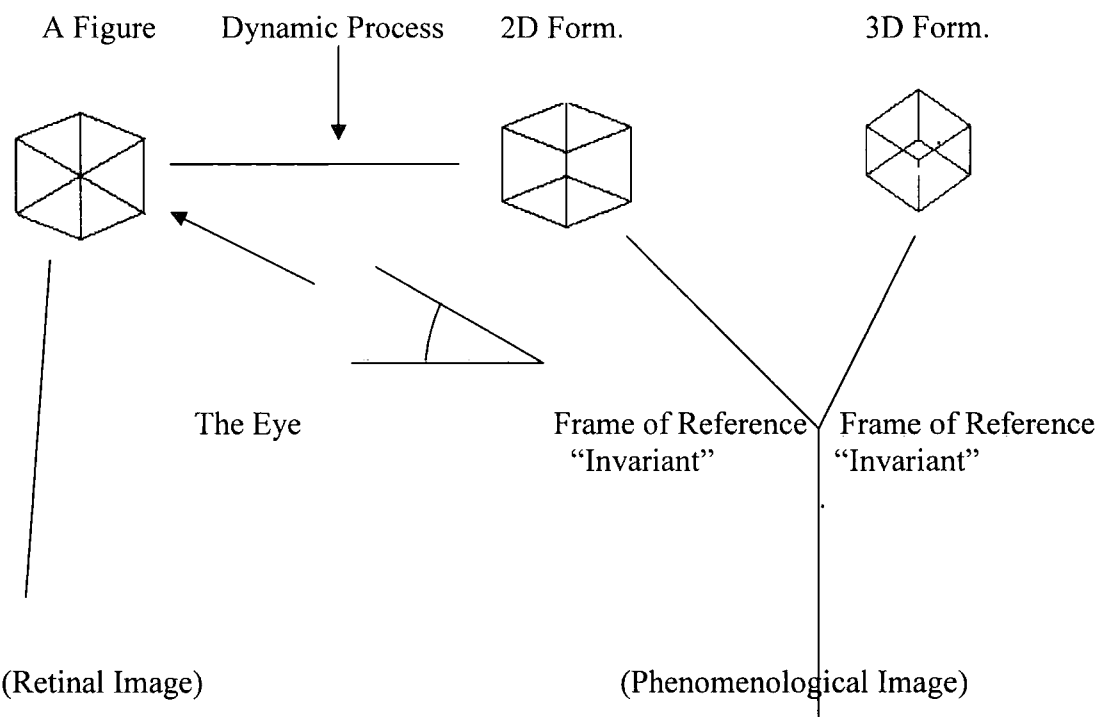


Figure (5-3)

In this diagram, the eye perceives a figure and this figure is represented on the retinal image. This figure is a *thing* and its properties are fixed and unchanged. However, the Gestaltists explained that the phenomenological image is representing *forms* and *structures*. The properties of these forms are flexible and changeable in respect to the frame of reference that presupposed to be invariant during perceptual transformation. This model can also be applied to all the Gestaltists 's experiments of visual perception.

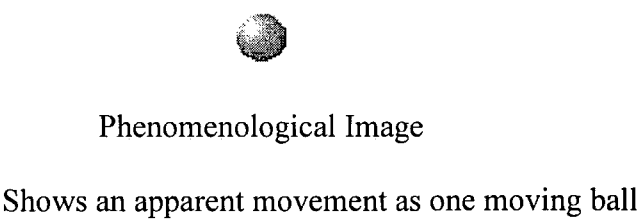


Figure (5-4)

Retinal Image of two motionless separate balls

the Retinal image shows two separate balls, as a *thing* while the phenomenological image shows a *form* of a moving ball that is really one ball presented first on the left over the stationary ball and then on the right over the right stationary ball.

5-3-2-1 physiological approach and perceptual organization

The main theme of that approach lies in the scientific facts regarding the retina. The Gestaltists claimed that various and different perceptual organizations of the same retinal image are possible. They explained the possibility of having different perceptual organization of the same stimulus during our daily life experiences. They showed that a perceptual change may occur even though there is no change in stimuli. In other words, our understanding can represent different perceptual forms of the same given figure although the physical stimuli remain unchanged. The Gestaltists gave attention to the physiological function of the retina to see how it performs during perception. The Gestaltists were interested in the debate between the physiologists like Hering and Helmholtz on the functions of retina. The debate is well known because it is based upon the divide between the nativist and the empiricist. This will be discussed in Chapter Seven. Therefore the Gestaltists depended on the physiological investigations to develop their knowledge and to make use of these investigations in their psychological research. Showing that the organization of the same parts of the perceived figure can be varied and re-ordered without changing the stimulus led the Gestaltists to contrast some other schools of psychology such as behaviourists as Watson and Pavlov as we showed earlier.

Koffka (1928) rejects Thorndike's view that is opposed to the Gestalt and hence Koffka set up his objection in light of Thorndike's statement. He considered that every act consists of three component parts: the perceptual situation, the reaction and the relationship between them:

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First the situation, within as well as without the body, which stimulates the individual; secondly, the reaction, a process within the individual which is a result of this stimulation; and lastly, the bond which makes this connection between the situation and the response possible. (Koffka, 1928: 94 quoted from Thorndike, 1914, 1).

For example, the Gestaltists refer to Pavlov's experiments in which a dog is trained to react when it hears a certain tone as a signal of food, especially when Pavlov did not feed the dog for a long time and the latter was starving. Pavlov usually supplies the dog with food after the tone immediately. Pavlov noticed that the dog, after hearing the tone a few frequent times, was physiologically ready to have his food even if the food was not immediately given to him after the tone. Pavlov explained the behaviour of the dog in terms of a conditional bond between the stimulus and the behaviour and he concluded that all the human behaviours and their responses are a result of these conditional bonds that we acquire in social and perceptual situations through training and learning. Rejecting Pavlov's explanation, the Gestaltists explained this fact by arguing that the animal had not responded to a particular stimulus but to the whole situation and the relationship between the constituents that may be arranged under one whole form as we shall discuss the Gestaltists' experiments to animal behaviour. (Hartmann, 1935: 116).

The Gestaltists used the physiological approach to explain how perceptual organization takes place between the parts involved in the perceptual situation. I will choose three examples that illustrate the flexibility of perceptual organization that takes place in the phenomenological images. The Gestaltists used reversible figures as a way of supporting their claim. The first example is a very famous one that has been mentioned in different literature on Gestalt. In figure (5-5) there are two possible figures, a young lady and her mother in law. We can perceive firstly either a young lady or an old lady and afterwards, it follows that we perceive a second form by re-organizing and re-grouping the constituents of the figure and therefore will construct different phenomenological form different from the figure perceived. The second example (figure 5-6 A) has the same property of reversibility, it also includes two possible phenomenological forms that can be constructed from the same constituents of the figure. The head is either that of a duck or that of a rabbit.

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The last example shows that a profile (figure 5-6B) can also be constructed and phenomenologically represented differently from the figure if we rotate it. We would have two possible phenomenological forms. For example when we rotate the figure 45 degree counter clockwise we would perceive a profile of a chef and if we rotate the same figure 45 degree clockwise, we would perceive a form of small dog (Rock, 1975: 264-265).

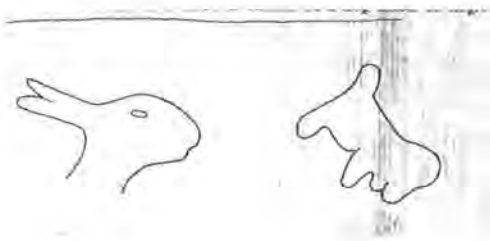


Figure (5-6A) Figure (5-6 B)



Figure (5-5)

These two possible phenomenological forms perceived in the last example can be simply viewed even if we do not rotate the figure 45 degree. The rotation of the figure only aims to simplify our perception and has nothing to do with the changes in the stimuli. These processes of rotation and transformation are dynamically functioned to bring possible forms out of the figure given in the immediate experience. Here we can see there are changes in the organization of elements composed the figures despite the fact that neither these elements nor the physical stimulus included in the perceptual situation have changed. The question now is how the Gestaltists explained the changes that happened to the perceived figure even though the stimuli remains unchanged in respect of their physiological perspective?

They justified that situation by giving an explanation of perception in terms of neural events. The current flow in neural cells causes a fatigue to the cortical medium. The state of neural fatigue will block the neural process necessary for the continued experience of the form that is perceived. They concluded that there is a positive relation

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between the cortical projection of the contour in the retinal image associated with a flow of direct current in the cortical medium and the perception of visual forms (Koffka, 1928: 22-23).

Although the physiological explanation of perceptual changes presented by the gestalt psychologists was a simple explanation, it did not have same scientific accuracy typical of physiological investigations of their time. As evidence of that Muller, a physiologist who defended associationism, explained the changes that take place in the perceptual forms by proposing a chemical theory of visual excitation according to which the processes of the retina and optic nerves involve reversible chemical reactions. Muller rejected the Gestalt's theory of fatigue nerves with his chemical theory of visual excitation. Being an associationist, Muller also objected to the Gestaltist's idea of physical forms as being structural wholes.

The Gestaltists defended their view that the elements of phenomenological object are organized and hence comprehended as being parts of holistic structures. Even their attempt to justify changes within perceptual forms was criticised by Muller. The Gestaltists had their own account to explain the changes of perceptual forms. They reject the ideas of both a Nativist like Muller and an empiricist like Helmholtz regarding their justifications of perceptual changes of forms. Instead, they chose functional dynamical theory to account for these changes, as we shall discuss fully in Chapter Seven. The most interesting point that follows their functional dynamic theory was to emphasize the importance and need to have holistic and systematic structures that are not derived from experience itself. The physiological approach indicated the need to appeal to holistic wholes to make perception of physical forms possible. Kohler asserted this fact in his *Gestalt Psychology* by showing the mistakes of the machine theory of local or physical stimulus:

It has been shown that many sensory experiences cannot be related to purely local conditions of stimulation because such local conditions never give rise to anything like those of experiences. The facts to which I am alluding are attributes only of certain areas in space and stretches in the dimension of time. Now, extended physical processes, the parts of which are functionally interrelated, may also have characteristics of their own, characteristics which cannot be related to merely local conditions. But machine theory of the nervous system excludes this possibility, because the assumption of extended processes with functionally interrelated parts is incompatible with the principal tenets of the theory. (Kohler, 1947: 120-121).

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To sum up, the Gestalists argued against the physiological approach of explaining the nature of perception. They found that the physiological approach could not give a proper explanation of changes that took place in perceptual forms and could not explain the dynamic process of transformations taking place over the phenomenological forms. However, the physiological explanation of the Gestaltists stressed the importance of going beyond the explanation of the modifications through changes in stimuli, as a necessary condition for these changes in phenomenological form. On the contrary, the Gestaltists showed the need to explain these changes in light of other holistic structures that are not derived from direct experience and need to be activated by dynamic processes. Now we will discuss another way of explaining the changes that take place in the phenomenological image that we call it as the geometrical approach of explaining perception and we will compare it with the physiological approach and see to what extent the geometrical approach addresses the structuralism of perception.

5-3-2-2. The Geometrical approach and perceptual organization

The Gestaltists explain the changes that take place in perceptual situations by using geometrical understanding and some geometrical examples to provide an explanation for the changes that occur in spatial forms of perception. We do not see a great difference between physiological and geometrical approaches, for both explain changes in light of the re-organization of the perceptual constituents of the phenomenological form that presuppose new structural orders of arrangements. The gestalt psychologists like Max Wertheimer and Kurt Lewin were concerned with geometry and used some geometrical examples to confirm their claims that perceptual experience presupposed a structural element that orders the detached parts in a systematic whole as we will discuss in both visual space and learning experiences.

Wertheimer used the projective geometry as a model to explain the changes that take place in a phenomenological image representing a spatial form. These changes are explicable through dynamic process of rotation and transformations as discussed in his examples discussed in Chapter Eight. Lewin also used topology as a way of defining his theory of social field. Therefore they used geometrical terms to apply them to perception. For example, the Gestaltists, through their work, used the terms, transformation and

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invariance in their mathematical sense and applied them to develop their theory of the perception of space.

5- 4 Experience and the Concept of Invariance

The idea of invariance gained its importance from Klein's view of geometry as explained in Chapter Four. This concept found its application not only in mathematics but also in social sciences.

Invariance is the nature of a quantity or property or function that remains unchanged when a given transformation is applied to it; "the invariance of the configuration under translation" The invariance as a principle aims to arrange the relationship between the constituents of the group in respect to a factor that remains unchanged (Fieandt, & Moustgaard, 1977:358).

In psychology there is a second set of items called the phenomenological or perceptual invariant. The Gestaltists meant by the concept of invariance that the pattern, through which we perceive and arrange the relationship between perceptual elements, remains unchanged when the conditions that determine the perceptual situation remain unaltered as shown in figure(5-3).

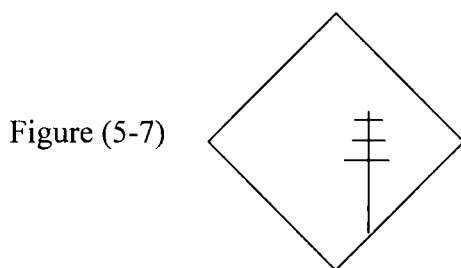
The Gestaltists used the concept of invariant in contrast to the hypothesis of constancy used by empiricists. The empiricists supposed that the relationship between a specific local stimulus and a sensation remains unaltered although the stimulus that hits a certain sensation changes. The Gestaltists objected to the empiricist's concept of constancy. For them the constancy is not the constancy of the *thing*, rather the constancy of the *form* or *structure* as we construct it to represent what is given in experience. The difference between the Gestaltists and the empiricists regarding the concept of invariance can be summarized under these two senses: according to the Gestaltists, any property represented in the phenomenological image has a relative place within a certain perceptual situation under certain conditions. However, according to the empiricists,

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any property represented in the retinal image has an absolute value in itself regardless of the changes of perceptual conditions.

For example, for the Gestaltist the colour as represented in the phenomenological image has a relative nature determined through the nature and the intensity of illumination, but the empiricist believes that colour represented in the retinal image is determined by the colour of the thing in the external world as having an independent property apart from the conditions which determine the perceptual experience. The concept of invariance played a role in the Gestaltists' views when they discussed issues like size, space, form, colour and movement. Koffka in his 1935 gives an example of what the Gestaltists mean by invariance:

When we look through the window of our mountain-railway carriage, this window becomes our spatial framework and appears, therefore, in normal, horizontal-vertical orientation. The contours of the objects seen through the window do not intersect the sash at right angles. Therefore, if the sash is seen as horizontal, these objects cannot be seen as vertical, but must appear leaning away from us on the ascent, and towards us on the descent. If Fig (5-7) gives a somewhat exaggerated picture of the real positions of the window and a telegraph pole, then it shows at the same time why the telegraph pole cannot appear vertical when the window becomes the framework and the picture until the lower side of the window is horizontal; then of course the telegraph pole is tilted to the right as much as in our drawing the window is tilted to the left. The angle between the pole and the window sash, then, determines the *relative* localization of the two objects with regard to each other, whereas their absolute localization is determined by those parts of the field which form the spatial framework. If one sticks one's head out of the window, the telegraph pole will soon look vertical; when then, without losing sight of it, one withdraws the head, the telegraph pole will still appear vertical and the windows, the whole carriage, tilted. One factor in these two situations is *invariant*, the angle between ground and object. (Koffka, 1935:218).



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The Gestaltists presupposed a structural element needed for the perceptual organizing experience and ordering the constituents of perceptual situation.

We can see here that invariance is not referring to a simple accumulated relationship such as co-existence or similarity, but a lawful and a functional relationship between structural order and the parts composing the phenomenological object.

It seems clear that the idea of invariance as considered as a structural idea manifests the possible ways to find various orders of grouping the constituents of the form as represented by the phenomenological image. For the constituents of a phenomenological form will be ordered differently, from the figure as represented by retinal image, in respect of the dynamic processes that lead to changes take place over visual forms.

The gestalt psychologists sought to show the validity of invariance when it is applied in perceptual experience. They gave different examples to show how the invariant as a principle can explain how the constituents of the form can be ordered with respect to certain kind of transformation under an invariant. For instance, both Katz and Gelb presented experiments on illumination and its reflection on visual perception of colour. They show that the colour of an object perceived can be represented differently when we display it in various illuminations and even in normal light with different degrees of intensity. Katz and Gelb showed that the colour of the phenomenological image is relative to the conditions designed in perceptual situation. Gelb showed in his experiment that the representation of the colour of a disk is changeable regarding the transformation occurred during perceptual situation.

In a dark room a perfectly homogeneous black disk is rotated; this disk, and nothing else, is strongly illuminated by a projection lantern. Under these conditions the disk looks white and the room black. Then the experimenter holds a small piece of white paper close to and in front of the rotating disk so that it falls within the cone of light. At the same moment the disk alters its appearance, and looks black. (Koffka, 1935:245-246).

In this experiment, the whole perceptual field was divided into two parts, a dark room and a black disk but when we added a new part, "the white paper" to the perceptual situation, the perceptual organization is totally changed. The strip of paper is a new

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condition added to the perceptual situation and led to a transformation by which the disk was phenomenologically represented differently (Hamlyn, 1957: 67-68).

The dynamic process presupposes the frame of reference of the person who perceives it to be invariant during the process of construction. Koffka stressed the importance of perceptual “reference frames” in stabilizing the perceptual field (Gregory, 1974: 27).

To that extent Cassirer and the Gestaltists shared the same idea of the importance of the concept of invariance in analysing the perceptual experience, as we explained in Chapter Four. Cassirer’s view of the invariance of experience also implies that experience must have systematic structures that allow a perceiver to arrange and to relate the constituents of form constructively.

The perceptual image as well involves that reference to certain possible groups of transformation. It changes when we refer it to a different group and determine the “invariants” of perception accordingly (Cassirer, 1944: 16).

After discussing the ways that gestalt psychologists tried to show the structural aspect of perception by applying geometrical concept of invariance, another aspect of the gestalt structuralism regarding perception will be discussed.

5-4-1 Group Theory and perceptual Transformation

Another aspect of the Gestaltists’ structuralism concerning perception can be viewed through another geometrical concept such as transformation. Both invariance and transformation are central to the Gestaltist’s analyses of perception. To perceive any object, we need to assume that shape perception is mediated by those geometrical properties of a figure that do not change (are invariant) when the figure is transformed in specific ways. Any given set of transformations partition the total set of figural properties into two subsets: those that change over the transformation and those that do not change. For example, when a form is rotated the line orientations of the form changes, but angle sizes do not change due to the fact it is invariant (Palmer, 1983: 275-276).

Klein used the idea of group to investigate whether geometry can be characterized by a group of transformations and he argued that geometrical systems are really concerned

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with invariants under a group of transformations. For Klein, the concept of transformation presupposes an invariant element, in respect to which, transformations will be understood (Kline, 1972: 917).

It was a difficult task for the Gestaltists to trace the structural aspect of perception through these geometrical concepts. However, in the history of science there are other philosophers and psychologists who were also interested in developing the structural view of perception: Cassirer, Piaget and Gibson also applied geometrical concepts to the field of psychology. Although there were differences between these philosophers and psychologists and the Gestaltists concerning their approaches and analyses of the nature of structures implied in perception, they agreed that perception proceeds in the light of general rules. For instance, Piaget and the Gestaltists were in disagreement on the concept of apriorism as applied in psychology:

The organism assimilates the action of the environment according to its own structure which is independent of the environment and resists any modification by outside forces. (Piaget, 1971:5)

The Gestaltists rejected Piaget's apriorism and instead understood structuralism as representing possible phenomenological forms through different dynamic processes. They indicate that any reaction is a function of many variables, which does not mean a sum total of different processes.

Sometimes the term "structure" is used in a purely geometrical sense. But when I use the term in our present connection, it refers to a functional aspect of processes, to the distribution of such processes. A distribution which they assume (and may also maintain) as a consequence of the dynamic interrelations or interactions among their parts. (Kohler, 1969: 91-92).

The Gestalt psychologists sought to bring the systematic and constructive aspect of perception through their experiments and interpretations of the facts of perception. This constructive aspect can be traced through different references in their works concerning perceptual transformations that take place during the process of perception. These transformations can be seen when we discuss perceptual space and the transformation of two-dimensional space to three-dimensional space, as we will see later.

By perceptual transformation, the Gestaltists meant a process in which there will be a phenomenal change to the form. In this process we can see a figure such as a square

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can be represented as a trapezium in the case of spatial transformation or a white sheet of paper can be represented as yellowish in the case of colour transformation.

The order of arrangements between the constituents of the form can be re-arranged differently when the perceiver functionally changes his perspective of representing perceptual form. In that case, the relationship between the constituents will be ordered in respect of the new structure that requires a sort of transformation of the relationship between the constituents of the form represented. As a result, certain transformations take place in the perceiver's perceptual field.

There is a new form represented in the perceptual experience that led to a kind of transformation from the form with narrow sectors to a form with large sectors. This new form has to be understood not as something in and by itself. It is a new whole that no longer depends on what a figure is as a particular thing. However, that a form is represented here shows that it is transformable and it has to be understood within a form into which it is integrated and in which it represented. Perceptual transformation determines the structures of perception to a considerable extent because we go beyond the particular given figure. But with these two concepts of invariance and transformation, we transcend the particular thing as having unchanged and independent properties as reflected by the retinal image to a form that has relative properties as represented by the phenomenological image.

The question now is, how one can perceive in this figure (5-8) different forms when the pattern of perception is changed. In fact a subject can perceive these two patterns of narrow and large sectors alternatively as long as he changes his way of looking to the figure. This process of changing presupposes a change of the form of arrangement between the parts of the form. Therefore there is always a chance to perceive at least two perceptual forms. We noticed that the more possible relationship that exist among the elements of a form, the more complicated will be the perceptual form we represent. In this example, there are two disciplines that suppose two different kinds of arranging the parts of the figure, each one of them relate differently between the elements composed the figure and hence we find two different perceptual forms. We already have a form with narrow sectors where there are spatial relationships between the points that are related in such way that allowed the perceiver to perceive a form with narrow

sectors. As a result, the perceiver can still perceive the same form but with slight changes that took place over the former form with three little sectors. I mean that the perceiver when he changed his frame of reference, he found a new order or structure by which there was new arrangement of constituents of the form and new different relationship could emerge by the new structure. In that case, the perceiver will perceive a form with three large sectors.



FIG. 8

Figure (5-8)

Another example shows that when an object is not well represented and does not show a significant figure, the perceiver can represent the figure and give it a well form by different processes of rotation for example which aims to re-arrange the constituents of the figure in certain way. In figure (5-9) the figure is not recognised but if we rotate it clockwise through 90 degrees, the shape can be phenomenologically represented and recognized immediately as the outline of the African continent once we find a suitable order of representation.

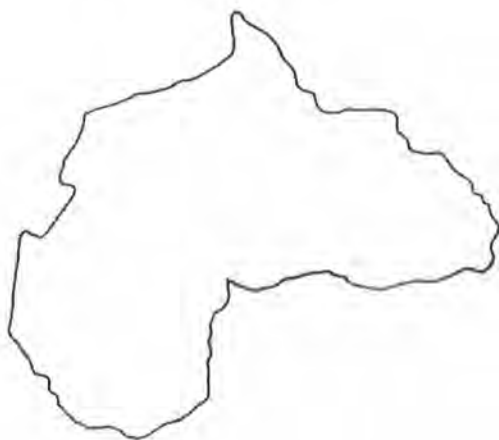


Figure (5-9)

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It is possible to define form or (shape) by the pattern of invariant relationships. A particular form is specified if no change occurs in our perception of it even if its elements or component features are changed. It is the relationship among the elements, independent of the elements themselves that define a form. (Haber & Hersenson, 1980: 306- 307).

Cassirer shares with the Gestaltists their view of perception is about how we represent them and construct them as they appear to us in perceptual situations. He argued that the object we perceive is neither given nor fixed. The structuralism of Cassirer and the Gestaltists rests on going beyond the given and instead considering the form as a constructive relationship between the constituents which are ordered under specific holistic form determining the characteristics of the represented form.

In perception, too, we do not confine ourselves to the particular, given *hic et nunc*, to be completely absorbed and, as it were, lost in it. We go beyond the particular and integrate it into a certain context. As the particular changes its position in the context, it changes its "aspect". We do not apprehend the particular as a mere "existence," that simple reality in which there corresponds a particular sensation to each particular stimulus. On the contrary, the apprehension of the particular qua "existence" involves apprehension of the possibilities of transformation which it contains within itself. (Cassirer, 1944: 15).

After discussing the physiological and geometrical approaches of perceptual organization, we need to investigate the validity of our claim concerning the structural account of perception by applying it to different perceptual phenomena. Therefore we will choose some examples discussed by the Gestaltists to examine the structural perspective of perception. Perception of motion will be discussed because it is a part of their view of visual perception.

5-5 Gestalt and the Structure of the Perception of Motion

The Gestaltists claimed that we perceive one thing as in motion between the two images. This view was a claim against the view which argued that what we perceive is a direct reflection of the stimuli given in perceptual situation and nothing else involved in retinal image than these stimuli. On the contrary, Wertheimer, like the other Gestaltists,

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argued that any object is not a bundle of segregated elements composed together. On the contrary, Wertheimer, like the other Gestaltists argued that any object is not an apparently unrelated aggregate of elements, but it is a structured whole:

The given is itself in varying degree “structured”(“gestaltet”), it consists of more or less definitely structured wholes and whole- processes with their whole- properties and laws, characteristic whole-tendencies and whole- determinations of parts. “Pieces” almost always appear “as parts” in whole processes. (Wertheimer, 1922 quoted from Ellis,1950: 14).

The Phi-Phenomenon is the theoretical psychological process that was suggested by Wertheimer, and it explains how a series of static images can be perceived as representing motion. Wertheimer published in 1912 this article *Experimental Studies on the Seeing of Motion*, in which a disembodied perception of motion is produced by a succession of still images. The classic phi phenomenon experiment involves a viewer or audience watching a screen, upon which the experimenter projects two images in succession. The first image portrays a line on the left side of the frame. The second image portrays a line on the right side of the frame. The images may be shown quickly, in rapid succession, or each frame may be given several seconds of viewing time. Once both images have been projected, the experimenter asks the viewer or audience to describe what they saw. At certain combinations of spacing and timing of the two images, a viewer will report a sensation of motion in the space between and around the two lines

Wertheimer supported the idea that the whole properties exhibit a structural unity between the elements of the whole. He thought that the properties of wholeness and structural processes implied in perception, presupposes a meaning that maintains the inner coherence of our experience:

Wertheimer’s primary aim was to show that apparent motion is a unitary experience where a new perceptual form begins to emerge. The experience was a full event, rather than a fragmentary sensation. According to the structuralism of Wertheimer, perception of movement implies a structure or a whole that is not the outcome of the simple aggregation of impressions. Therefore Wertheimer asked whether apparent motion is caused by the total aggregation of stimuli or whether it presupposes another structural whole that has to be considered the cause of apparent movement?

(Wertheimer, 1912, 1034 From Shipley, 1961:1032-1089).

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Wertheimer ascribed the quality of an organized whole that relates interdependence to its parts. The quality of structure- function that he ascribes to perception is completely distinguished from the aggregation of impressions since the units of the impressions are assumed not to have functional relations. This understanding brings us to assume that perception, according to Gestalt, means that we grasp our perceptual perspective through the response that comes directly from a reaction to the total stimulus- complex rather than to its components. This understanding can be traced from the Gestaltists's application to the perception of moving objects. Wertheimer claimed that the apparent movement of objects is the result of responding to certain wholes or structures that group these impressions according to certain order.

For example, the phi- phenomenon explains the Gestaltist's account regarding apparent movement that means that an object *seems* to move from one position to another when it is merely presented twice in two different places with an appropriate short time interval between both exposures. Although the perceptual situation includes a group of stimuli, none of them can independently explain the apparent movement of things. I have discussed earlier in this chapter Wertheimer's experiment concerning two spots of light that are flashed off and on alternately with an interval between them more and less than 0.2 seconds. The development of apparent movement can be traced with the aid of two electric bulbs and a metal upright. If we place two lights along the edge of a table separated by a few feet and between them and the wall of the room we stand a thin rod. If one switches the two lamps on and off, the shadow cast by the rod will move back and forth in lively style between the two positions. If the time between the two light exposures is less than 30 milliseconds, the two shadows of the rod will appear simultaneously; if the interval time is too long then mere quiet succession is noted. Wertheimer's experiment on apparent movement can be noticed in our daily life.

For example, in traffic lights, at the changing of lights when the red light seems to be converted to the green. It seems to us that there is an apparent movement that takes place from the red light to the green light. In addition to that, we can clearly capture apparent movement through animated cartoons. Although they are group of separated drawings when they are displayed together and the time between every drawing is short, we perceive these separated pictures as a whole portrait. We do not ascribe the qualities

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of motion, liveliness and vivacity to each drawing separately but when they are grouped together in a holistic structure new qualities will be added to them.

Wertheimer in his 1912 article *Experimental Studies on the Seeing of Motion* presents another example of apparent movement (Kaufman, 1974: 383-384).

If we draw two lines on the strip of a stroboscope, where the first line is a 3 cm horizontal line at the beginning of the strip and a second line is in the middle of the strip about 2 cm lower. Wertheimer explained that if we rotate the stroboscope slowly what we shall notice is that one horizontal line appears and then the other and they both appear clearly separated from each other. If we rotate the stroboscope faster, then one can see them simultaneously, one above the other, they are there together at the same time. However, if we increased the speed of the rotation too much, then these two lines can be perceived not only together but also as if they have definite motion. We can clearly see one line instead of two separate lines and this line moves clearly from an upper position into a lower one and back again. (Wertheimer, 1912 from Shipley, 1961: 1035-1036).

From Wertheimer's experiment concerning the two horizontal lines that seem to move, the Gestaltists could present evidence that perception implies certain holistic structures that organize the separate constituents of the perceptual situation.

We shall discuss now another experiment that explains the relationship between light and movement. Rubin studied the structures represented as displayed in light. Rubin's experiment aimed to show that the light, when it reflects on a moving object, moves with the object, despite the fact the light is unmoved. He designed an apparatus in a way that enables a wheel to revolve inside a ring that was observed in a dark room. Rubin designed the ring to be twice the diameter of the wheel. His idea was to place the light on the moving wheel, the result was that the observers reported that they perceived the light moves linearly back and forth. In addition, Rubin placed six lights different on the wheel and again the observers reported that the lights moved linearly.

The significance of Rubin's experiment was to show that apparent motion is a quality that can be comprehended only in the light of a structural whole. It is a dynamic whole that transcends the simple aggregation of elements. It adds to the elements a comprehensive form that goes beyond a mere summation of elements. According to Wertheimer, the essential features of the phi phenomenon are the following: it is a counter example to the assumption that piecemeal and summative approaches to

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psychological phenomena are universally adequate; it belongs to a category of genuine dynamic experience which must be understood in terms of dynamics rather than reduced to static events; finally, it is an example of a structure that is not an arbitrary arrangement of events but has inner connectedness.

The idea of a structural whole is presupposed in the perception of apparent motion. Although the perceptual situation includes only different segregated parts, none of these constituents involves movement. However, the apparent movement is an outcome of a functional constructive process that transcends the simple segregation of the parts. This structural whole is nothing more than the pure possibility of constructing forms that can order the separated elements and reunify them under comprehensive order. In order to understand that structural whole, Hartmann's comment on Wertheimer's view of phi-phenomenon provides some interesting insight:

Wertheimer proposed calling this concrete observation of apparent motion the *phi-phenomenon*, the Φ standing for whatever occurred between **a**, the first exposure, and **b**, the second. Under special conditions, "pure" phi was obtainable; i.e., the observer saw neither **a** nor **b** the movement, but simply "something in motion" this is a genuine "dynamic" occurrence which on neither a priori nor other grounds requires to be traced to a "static" base. (Hartmann, 1935: 6).

The Gestalt was a theme for constructing phenomenological forms where the content of experience can be functionally constructed through dynamic processes of rotations and transformations. The question now is to what extent the Gestaltists could apply these constructive aspects to visual perceptual space.

Gestalt and the Structural Aspect of Visual Space

6-1 Introduction

The aim of this chapter is to describe the structural aspects of the Gestalt theory of perceptual space. Therefore in this chapter our aim is to prove the claim set up in the previous chapter concerning, the Gestalt structural account of psychology. We will try, in this chapter, to examine some of the Gestalt experiments on perception regarding space. The question of whether or not there is a relationship between the Gestalt psychologists' view of perceptual space and Cassirer's invariance theory of experience will also be addressed. By examining the perceptual experience of space, we shall be able to see how the Gestaltists were structuralists by discussing the difference they made between retinal and phenomenological image. I will try to identify the degrees and aspects in which the Gestaltists's view of perception is structuralist. The question now is, what are the basic features of structuralism as revealed through the different aspects of perception as seen by the Gestalt School? The answers to these questions will be illustrated in detail throughout this present chapter.

6-2 The Problem of Visual Perceptual Space

Visual perceptual space is one of the most controversial issues in perception. Various psychologists, physiologists, and philosophers have discussed perceptual space through the ages, but it is difficult to study perceptual space, as an independent issue, separate from physical space, because every aspect of perceptual space needs to be developed and understood in respect of physical space. Perceptual space does not develop in a vacuum, rather it needs strata in order to interact and flourish. When we study perceptual space, we start from the assumption that the physical world exists externally and independently from the observer. The perceptual world is experienced by the observers and their visual world is produced through the activity of the brain- eye system when light stimulates the eyes of the observer in a perceptual situation. A visual

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image can be explained as a mechanism between the nerve system and the eyes. The nerves in the sense organs when they are stimulated, send signals to the brain that will be translated by the brain and compose our responses in different perceptual situations.

There is disagreement among psychologists and physiologists as to the nature of perceptual space. In the nineteenth century there were two distinct groups; nativist and empiricist, each with a different account. First there are the nativists, like Hilbert and Hering, who claimed that visual space can be understood in light of inborn activities. For example, Hering attempted to explain visual perceptual space within his theory of *local signs*:

This theory stated that each point on the retina has specific innate signs or values for height, width, and depth which correspond to specific heights, widths, and depths in the external world. (Forgus, 1966:183).

Hering indicates that spatial phenomena can be explained by the fact that the visual system can not be regarded as a mosaic of independent response elements that corresponds to a simple mosaic of stimulus elements. On the contrary, the visual system must be conceptualized in terms of the tissues of an interrelated whole, rather than independent elements. Hering, as a physiologist, attempted to explain perceptual space by attributing positive depth-values to the points on the nasal halves of the two retinas and negative depth -values to the points on the temporal halves (Helmholtz, 1962: 613-614).

In addition, Hilbert, the famous German geometrician, in his *Foundation of Geometry* shared Hering's view of the intuitive nature of space as applied to geometrical space. Hilbert supported the idea that geometry is a pure theory of relations. Geometry is not concerned with the objects but it is concerned with the spatial relations that the figures occupy in the system. Therefore, geometrical space is not a space of objects but it is a space of pure relations and possible orders of placing figures. He clarified this by saying that any geometrical system can be nothing but a certain system of order and relations whose character is determined by principles governing the relationships, and not by the nature of the figures entering into it. Hence the points, planes and straight lines of Euclidean geometry can be replaced in endless numbers of ways by other different

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objects without the least change in the content and truth of the corresponding theorems (Cassirer, 1950: 25-26).

This view is not concerned with the material or physical objects that occupy perceptual organization but it is more concerned with the spatial relations that are organized within a holistic system. In contrast Helmholtz, an empiricist, claimed that there is no epistemological need to presuppose these inborn activities because any determination of space is a matter of experience. According to empiricists, perceptual space is not specified by the innate activities of the mind. Helmholtz states that:

Thus the assumption of a definite intuitional basis for perception of depth breaks down, because, without either coming squarely in conflict with the observed facts and hypothesizing purely fictitious depth-values that have never been proved to exist, or making assumptions, which have no foundation or analogy anywhere else, as to what ought to be determined by intuition, we are utterly unable to state what sort of basis it might be and what it could determine or simply prefigure. (Helmholtz, 1962: 614).

Helmholtz explains perceptual space by attributing it to the field of experience and experiment. If the nativists and empiricists did not resolve their debate on the nature of perceptual space, the Gestaltists' views can be understood as a compromise between these two views. A gestalt psychologist will argue that perceptual space is neither intuitive nor empirical but it is an organizational space reduced by the dynamic processes of the brain. For instance, Koffka explains that spatial phenomena presuppose both inborn activities and experience. Therefore he adjusted a reconciliation view concerning spatial explanation of objects combined between nativists and empiricists, although in his (1928:53-54) Koffka objected to Stren's theory of convergence that states every explanation of perceptual phenomena is the result of the constant cooperation of both inner and outer conditions. It was Kohler in his (1947: 117) who transcended the controversy between nativists and empiricists by claiming that both these views can be resolved by the new approach to viewing sensory impressions as dynamic resultants of the complex immediately given situation. A Full discussion of this theory will appear in the next chapter.

Kohler claims that sensory experience is not a mere mosaic or an entirely additive aggregation of facts. Sensory experience can be understood only when we realize the

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dynamic structure implied in the parts. Perceptual space is a whole not a mere addition of separate units, a whole structural system (Kohler, 1947:114-115).

In what follows, I will explain the three general perspectives: the nativist who supports the idea of intuition and inborn activities of mind, the empiricist who emphasises the role of learning and experience in understanding perceptual space and finally the Relational perspective. The relational perspective presents the foundations of the Gestalt interpretation of perception generally.

To the Gestalt Psychologist the whole stimulus field determines the perception of each individual part of the whole scene. The parts cannot be “added” independently together to make up the whole, because the parts will change as we extract them from the pattern and the whole pattern will change if we add a part to it. It is now generally accepted that much of the Gestalt descriptive doctrine is true. The perception of the physical object is considered to depend in part upon its field and upon what has been learned in previous exposures to the pattern, so the study of perception is indeed the study of patterns. (Corcoran, 1971: 19).

6-3 Gestalt and the Structuralism of Perceptual Space

Perceptual space can be described as the place where we act, move and interact with others, either persons or objects. We can ascribe some properties to perceptual space such as: depth, distance, location and direction. These properties may vary and the objects that occupy space may have some spatial properties such as: size, shape, and motion. Specifying the nature of these representations of visual space was an issue that led philosophers and psychologists to a controversial issue of how we can perceive figures in visual space. Answering the previous question led psychologists to present different answers of how one perceives spatial objects. Some of them adopted the experimental associative attitude which focuses on the retinal image as a product of the relationship between stimuli and eye nerves. Among those psychologists, some who explain spatial properties of a figure represented by retinal image in respect to a one- to-one relationship between the stimulus and the eye nerves. Other psychologists such as the Gestaltists understand the spatial characteristics of the forms not as *things* and hence have fixed properties, rather they ascribed relative and changeable spatial properties of the forms as represented by the phenomenological image. For example, a circle as represented in the retinal image as two dimensional *figure*, it can, regarding to the

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Gestaltists, be represented as two dimensional *form* as an ellipse in the phenomenological image by a dynamic process of rotation and also can be represented as three dimensional *form* as a sphere or as a cylinder by a process of transformation if we perceive the circle as having volume. The following figure shows the difference between retinal and phenomenological images in representation and how figure as a thing in the retinal image differs from the form represented in the phenomenological image as shown in figure (6-1).

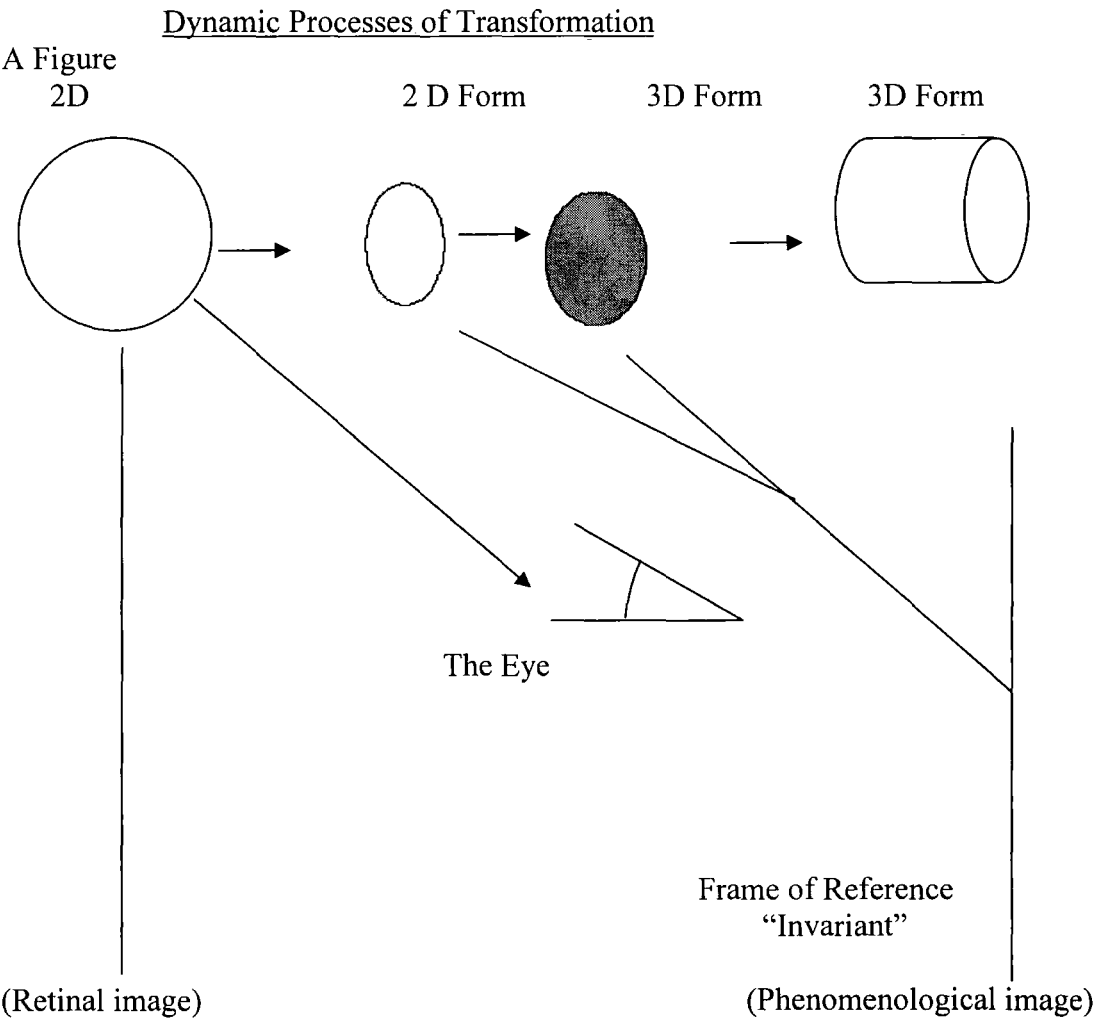


Figure (6-1)

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The Gestaltists gave various examples showing that if four non-intersecting lines of equal length are placed very close to each other but none of them intersect the other, in this case one can perceive them on retinal image as four separate and independent lines or one can represent them as a form of square. The problem of ascribing properties to represented forms depends on the processes of how one rotates and transforms the form and the degree of rotation and projection. All these processes determine the spatial properties together under one of forms. The Gestaltists argued that spatial properties can be grouped and organized differently so when a person changes his frame of reference.

The structure, in which the form represented according to the Gestaltists, is prior to the spatial properties of the figure. The Gestalt view of perceptual space indicates that since the structural whole precedes the spatial properties of any figure then any represented spatial form does not have unchangeable properties but elastic and flexible spatial properties that can be represented differently in respect to the structure generated through the dynamic process of transformation. The Gestalt psychologists, through their experiments on visual space, confirmed the relative characteristics of represented forms. Their understanding was based on Functional- Relational thought where concern is paid to the structure or the whole over the parts. The Functional- Relational thought confirms the relative state of the object of knowledge, as constructed by the reason under constructive orders.

The same application of the Functional-Relational thought is involved with the Gestaltists where the construction of the form of representation is preceding the constituents of the forms and the order of arrangement over the parts and hence these orders require the holistic forms provided by the mind through the processes of transformations. In addition, if the functional relational thought is broadly an application of the transcendental account, the transcendental view is involved in the Gestaltists' view on perception. This transcendental view distinguishes the Gestaltists from the other psychologists in their views on perception. The Gestaltists supported the idea that reason has comprehensive orders of organization that have to be taken in account as we could notice them in their laws of perceptual organization. Their view was to show how represented forms are dynamically constructed by the

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phenomenological image and the represented forms can variously constructed by the processes take place in the reason. In their approach to apply that functional-relational thought, the Gestaltists used different terms that functioned to show the elastic nature of *forms* as opposed to *things* with independent properties.

The Gestalists used the term *frame of reference* or *frame of work* to consider one of the functional-relational categories. The notion of a frame of reference shows that the characteristics imposed by the form remain unchanged under a certain frame of reference that was supposed to be invariant unless another transformation takes place which requires a new order of arrangements and hence a new set of properties. This idea is the general aim of the functional relational approach which confirms the importance of invariant elements for understanding the variable elements. Therefore the representation of visual space is developed in light of the perceiver's frame of reference, and determined through the dynamic processes of transformation. The Gestalt psychologists claimed that, either when we represent a figure in a normal visual space or in mirror space or when we represent the figure through different mirrors that may distort its original form, there are some constant elements in our perceptual experience.

Visual space is entirely determined by the frame of reference of the total field. What Koffka presumably was pointing out with this statement is that the mutual relations among the local elements were maintained even in the distorted "mirror space" because they were all lawfully displaced together according to a consistent rule. (Fieandt, 1969: 210).

The phrase "frame of reference" could be confused with a mathematical or physical one. Indeed there was a slight difference between the Gestalt psychologists and Cassirer regarding the phrase. This difference does not lie in the function of the concept, but lies only in the terminology. For example Koffka did not use the term frame of reference but instead he used another term for the same idea: "*framework*". Koffka assumed that there are two kinds of elements implied in the perceptual process. On the one hand are the physical elements of the figure we perceive. Then, on the other hand, are non physical elements or structural elements that organize the constituents of the form. Koffka chose the term "framework" to refer to a structure element involved in perceptual organization:

We have also seen that the environment contains not only things, even if we use the term in the broadest sense, but also not- things. Particularly we find the things *within* something that is not itself

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a thing. The things do not fill our environment either spatially or temporally; there is something between them and around them. In order to have a convenient term for this we shall call it the framework, so that, disregarding the great variety of things, we can divide the behavioural environment into things and framework. (Koffka, 1935:72).

We have found that Koffka's preferred term to point to the element that remains invariant during visual phenomenological representation was "framework". However, he sometimes used other terms to express the same idea like *system of reference* (1935.P282) and he used once another term to point to the same meaning *frame of reference* in his (1935.P283) when he was discussing perceived motion. He indicated that in motion there are two elements; the stronger element is stable and invariant because it will be seen at rest but the weaker element will be perceived in motion. The relation between what is constant and what is changeable will be relative, depending on the element that we fixate to be invariant:

We fall back on our distinction of things and framework and our knowledge that framework is more stable than the things within it. If we apply this to the case of motion we must deduce the following proposition: if one of the two field objects has the function of framework for the other, then it will be seen at rest and the other as moving no matter which of the two moves in reality. If on the other hand the two objects are both things, then under symmetrical conditions (fixation between them or freely wandering regard) they should both move in opposite directions. (Koffka, 1935: 282-283).

The meaning of "framework" as it was defined by Koffka, was shared by other Gestaltists, but under different terms. Ehrenfels's concept of *form-quality*; Wertheimer's concept of *Pragnanz*, Kohler's concept of *Structure*, and Kurt Lewin's concept of *Field* (sometimes he used the term *Region*). It seems clear that all these terms are closely related since they presuppose an invariant element involved in perceptual experience. I would like to use Cassirer's own term that is "frame of reference" because it seems that all the Gestaltists' various concepts can be unified under the term "frame of reference". Cassirer and the Gestaltists agreed on the necessity of having an invariant element implied in any perceptual experience, and on the active role of the mind in spatial perception. This activity refers to the importance of the structure over the content of perceptual experience.

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The idea discussed here is the importance of frame of reference in visual representation. It can be defined as follows: the frame of reference is a structure that presupposes a kind of arrangement between the constituents of the structure. This order of arrangement is changeable in respect of the frame of reference which remains invariant when the form is represented. For instance a form can be perceived as two dimensional and if we turn it 45 degrees, it can be represented as three dimensional as we shall explain later.

The problem that needs to be solved is the question, whether or not the properties of a represented form have independent or relative properties. In other words, does the perceived form represent a thing or represent a constructive whole? For example, consider a square where a straight line intersects two of its edges say A and C. Although the square has spatial properties there is the possibility of representing the square with a straight line intersecting two of its edges, as a pyramid that has four symmetrical spatial properties with two sides hidden. Moreover, the same square with a straight line intersecting its edge can also be represented as two equal triangles. The problem of the Gestaltists was to claim that form of the square is not representing a thing in itself, but a holistic form as constructed in the representation. There is a similarity between geometrical forms represented in a perceptual situation and geometrical figures as they are presented by mathematical thought. This similarity lies in the fact that both the representation of perceptual space and space as discussed by mathematical thought deal with geometrical figures, not as things with fixed properties but as forms having relative properties.

Both mathematicians and Gestaltists are more concerned with possible forms that require new different structures of relationships between the structure and its elements. Both mathematicians and the Gestaltists argued that space is and remains a system of relations in the sense that every particular construction in space denotes an individual position that gains its full meaning only through its connections with the totality of structure. Therefore, the claim that construction of geometrical forms as represented in the phenomenological image contradicts the theme that figures have properties as things. Perceptual space, according to the Gestalt psychologists, has to be understood in that context. Thus, Cassirer claimed that the "relativity" ascribed to exact-scientific constructions in general, can also be applied to perception because perceptual space is

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transformable and spatial relations can be re-ordered differently within new spatial systems that remain invariant during the spatial transformations.

This understanding can be developed from the examples given by the Gestaltists concerning perception of space. For example, the following figure (6-2) can be represented in two ways: as two triangles joined at the apex or as two intersecting oblique lines with two left ends and two right ends joined together.

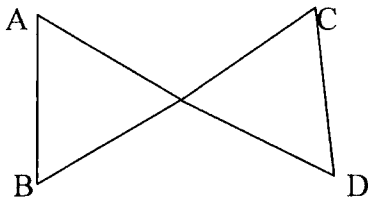


Figure 6-2

Although it may seem that the figure as we perceive it, has spatial properties ordered under a certain form, when the same figure is represented at a different angle, spatial properties will be merged and ordered under different form. It is necessary here to discuss an issue that apparently contradicts the claim concerning the relative properties of the forms represented. This issue relates to the problem of the constancy of perception. The question now that has to be addressed is, to what extent should one understand the concept of constancy of perception? Does the property of constancy conflict with the relative nature of forms?

The following paragraphs will try to answer this question by showing that there is no clash between the relativity of spatial perceptual figures and the concept of constancy. The reason this apparent clash will be denied, is that there are two meanings of “constancy”. Neither conflicts with the relativity of spatial forms as represented in the phenomenological image. The first meaning of constancy refers to the constancy of the framework. The constancy of framework refers to the one –to one relationship between figure or retinal image and representational content given the frame of reference. Of course the frame of reference itself is not fixed. This means that the frame of reference is more than connections of spatial relations between parts, it is a structure or a system of arrangements that precedes spatial relations.

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For example, a form can be represented as two or three dimensions with depth properties when it is transformed or rotated. It is the structure that determines the properties of the form as two or three dimensional as in the case of a circle represented as two dimensional as a sphere and represented as three dimensional form as a cylinder. What determines the form of representation from 2D to 3D is the structure that remains invariant under rotation of the form. This understanding shows that the representational content of the geometrical figures we perceive is not fixed and absolute, but varies according to the perceiver’s frame of reference. Thus, for instance, a 2-D geometrical figure (e.g. figure 6-1) might represent two different 3-D shapes, which will transform differently under spatial transformations like rotation.

The Gestalt psychologists understood perceptual space represented by phenomenological images as a kind of transformation taking place under invariant form. For instance, M. Von Hornbostel’s experiments on optic inversion strongly support the idea that perception of a phenomenological form can be represented differently depending on the frame of reference. For that reason, Hornbostel designed some wire models of solids of the type sketched in figure (6-3) and held them before a mirror in various positions. When such a figure rotated, it changes from one apparent shape to another. He concluded that the figure 6-3 can be comprehended in at least four ways. For example, we sometimes perceive a convex form and sometimes a concave form (inreversion). Hornbostel confirmed that these inversions are neither illusory nor ideational “constructs” but forms which under special conditions we perceive (Hartmann, 1935:107). The significance of this experiment is to show that the 3-D “content” is not inferred from a 2-D figure.

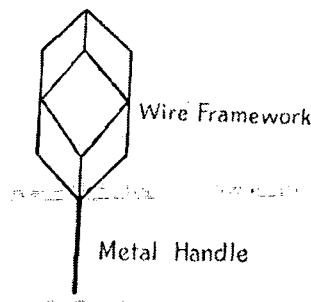


Figure (6-3)

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The phenomenal properties of a “convex” percept are typically distinct from a “concave” one. A convex affair is closed, excludes the observer, projects forward, cannot be penetrated visually because of its opacity or manipulated because of its impenetrability. Visual “objects” are convex. A concave item, on the other hand, is open, embraces the observer, permits visual and manual exploration and possesses the characteristics of an empty background. “Spaces” are concave. The entire process of inversion involves making a convex item concave and vice versa, although for some reason it is normally harder to invert a convex object than a concave one. (Hornbostel, 1922:130-156 Quoted from Hartmann, 1935:107).

Hornbostel’s study shows how it is possible for an individual to represent one figure in different forms. This understanding explains the claim that the Gestalt psychologists transcended the ontological view on visual perception where the forms as represented do not have unchanged spatial properties in themselves. The second issue that has been addressed is that there are various structures and frames of reference, each having the ability to group and order the elements of spatial forms and find new sorts of relations among them. Koffka again expresses his view that perceptual space is understandable in the light of these structures and the dynamic process of rotation and transformation taking place over the representation of forms:

Lines, under normal conditions, are not lines by themselves, but lines belonging to, or bounding, the surfaces of these things or those that confine our space. Therefore these lines will be determined in their direction and other aspects by the things or surfaces to which they belong. Otherwise expressed: it is an altogether futile task to build up perceptual space from points or lines, i.e. “space sensation”; again we find that visual space can only be understood as the product of field- organization. (Koffka, 1935: 215).

The Gestaltists emphasized the process of transformation that takes place in visual space. It means that these kinds of constructive transformations determine the properties of the forms:

An ellipse turned round its vertical axis so that its retinal image is more slender (horizontal axis relatively shorter) than that of the same ellipse in a normal position. The result is that the ellipse appears turned and not as slender as it would if its retinal image were produced by a frontal parallel ellipse. Otherwise expressed, the forces in the plane of the ellipse must, owing to its being turned, be such as to extend it horizontally. These are not the only forces in the field, as we see when we consider the case of a rectangle turned in the same way. Not only does its retinal image become more slender with this change of

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orientation, but its shape is transformed from rectangularity to that of a trapezium. (Koffka, 1935: 231-232)

The Gestalists opposed the empiricist's explanation of constancy who indicated that experience taught us that things are constant, having such and such properties. Koffka claimed that the mistake of the empiricist is to consider the hypothesis of constancy as irrefutable. The empiricist claims that the figures of perception seem to retain their normal appearance despite some drastic changes in the conditions under which we perceive them. For instance, constancy of figure refers, according to the empiricist, to the outlines of a figure that are preserved when a change takes place. No doubt the "constancy hypothesis" is irreconcilable with the dynamic character of the Gestaltist's view of perceptual transformation. On the contrary, Koffka and the Gestalt psychologists explained that constancy of the perceptual form does not imply a reference to a static state of precepts but rather constancy refers to constancy of phenomenological image. In other words, according to the empiricist, percept is determined by retinal image. Retinal image may vary, but subjects report perceptual image as constant. However, the Gestalt version of constancy (for percepts) is a distinction between retinal image and phenomenological image. The Gestaltists think that phenomenological image is constant across changes in the retinal image.

We produced a still stronger argument against empiricism when we showed cases where our perception is in accordance with our laws of framework and invariance but contradicts an explanation in terms of experience and reality. (Koffka, 1935: 224).

The Gestaltists pointed out that constancy refers to the fact that percepts seem to retain their "normal" appearance although there are sharp changes in local stimulus conditions. In fact this understanding is not only applicable to size constancy but also applicable to colour and form constancy. For example, size constancy refers to the fact that there is "preservation" of apparent size in spite of differences in the retinal image. All these aspects of constancy refer to the fact that the "constancy hypothesis", is invalid and incompatible with the constancy of the phenomenological image that emerges in the perceptual situation. The reason to maintain the real percept is to explain the difference between optical illusion and vindical perception. A second reason was to confirm the distinction between a percept and an apparent phenomenon because forms do not have

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characteristics independently of the way we perceive them. For example, the Gestalt psychologists sought to prove that it is a mistake to think that the retinal image is representing and reflecting the properties of any object apart from the apparent image of the same object when we perceive it. For example, we treat objects as if their actual size is independent of their perceived size. This issue can be verified through different examples that show the spatial form seems to be perceived constantly although its apparent size, shape, and depth vary widely.

An example given by Hochberg explains the first meaning of spatial constancy as interpreted as constancy relative to the frame of reference. His main concern was the question of whether or not our experience of perceiving a particular figure will change it or not. That is why Hochberg designed the experiment of the disc to show that our perception of the shape of the disc will be unchanged even when the conditions of the experiment change or our perception is altered in respect to these changes.

If a round disc with a shining white surface is slowly turned around its axis to an oblique position in a sufficiently dark environment in which other surfaces are not visible, and far enough so that the lens of the eye cannot accommodate to parts of the disc located at different distances, constancy of shape is no longer preserved. The subject soon announces that he sees an oval shape. (Fieandt & Moustgard, 1977:359-360).

In this example, the retinal image shows that the disc is attributed as round, but the characteristic of roundness is not a permanent characteristic because the disc can have different characteristic when represented in the phenomenological image under a process of rotation. The disc will be represented as an oval instead of round and the form of oval will remain unchanged when the phenomenological image is invariant with respect of the condition determine perceptual situation.

A second example from Koffka shows that the first meaning of constancy does not refer to the figures as things having independent properties and hence unchanged ones. Rather it refers to the figures represented as forms in the phenomenological image with elastic and changeable properties determined by frame of reference. In the following example, Koffka designed an experiment to allow a subject to look at the reflection of a room in an inclined mirror through a tube that eliminated the rest of the surround.

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The observer reported that the room (not the mirror) appeared to be inclined and that the objects in the room were arranged in a disorderly fashion. During the early part of the observation the subject was quite disoriented in space, but as time elapsed, the room was seen to recover its usual spatial framework and the subject regained his orientation. (Forgus, 1966:186-187).

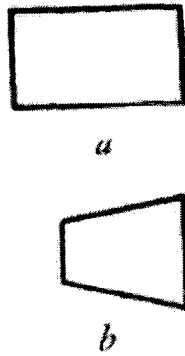
This experiment was designed to show that there must be distinction in the perceptual situation between what is represented by the retinal image and what our understanding infers from phenomenological image. The perceiver shows that the room as a percept appeared in a disorderly fashion of the room. He depends on the mere retinal image representing the room the way he reported. However, he responded differently when he could set up a new form to explain the disorderly fashion of the room. This form of order is not given by the retinal image, rather is constructed by the mind. Accordingly, he could realize the orientation of the room when the mind provided him with a form of arranging the contents of the room that presupposes the relationships of the contents of the room will remain unchanged under that form as represented by the phenomenological image which supposed to be invariant in respect to the conditions set up in the experiment. The forms are not the production of stimuli which hit the sense organs, but they are the production of dynamic processes take place in the mind and could explain what the retinal image fails to answer in the perceptual experience.

Another example was discussed by Koffka when he was arguing against Eissler who defended the empiricist's account that the geometrical figures represented by the retinal images have independent properties. Koffka gave an example (Figure 6-4) that shows how a square can be represented in the phenomenological image as a trapezium. Koffka confirmed the idea that it is the form that determines the characteristics of the contents under that form. The order of arrangement of the contents of the form remain relatively connected together unless another dynamic process of rotation or transformation occurs which requires a new set of ordering these contents under different form.

If a square surface produces a square retinal image, and is seen as a square in a frontal parallel position, then a circular after- image projected upon it will also appear as a circle. But when now this square is turned, say, by 45 degrees around a vertical axis, it is projected on the retina as a trapezium, but is seen as a square in a non- normal position. Now the circular after- image projected upon it can no longer look like a circle. For if a trapezium looks like a square, a circle can no longer look like a circle, if we are permitted this somewhat elliptical formulation. Correspondingly, a real circle on the

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square will in this new position produce the retinal image of an ellipse, but will be seen as a circle, for when a certain trapezium looks like a circle. (Koffka, 1935: 222-223).



(Figure6-4)

Koffka's aim was to stress the idea that visual perceptual space has to be developed in light of the perceptual transformations that reveal the constructive relative characteristics of form. The Gestaltists argued that these sorts of transformations are parts of dynamic processes that take place when we represent the phenomenological images.

The result of Kohler's experiment makes it clear that training or pre-exposure does alter the way an individual responds to identical patterns of stimulation on the retina. Clearly the retinal pattern of stimulation did not change; rather the individual learned to make different responses to the same stimulus relationship so that his behaviour became more adaptive. Moreover, this learning can become so differentiated that different responses are made to similar patterns of stimulation coming from different areas of the visual field. (Forgus, 1966:196).

These three previous examples explain the first meaning of constancy as it is identified in (p, 212) as the form represented by the phenomenological image presupposed as unchanged under the dynamic process of rotation. This discussion has attempted to show the Gestalt psychologists' rejection of the empiricist's view of constancy. It has also tried to explain their view regarding the constancy hypothesis which implied another structural property that differs from the claim that geometrical figures represented by retinal image have independent and unchangeable properties.

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The Gestaltists used two different terms to indicate the structural view involved in perception. The Gestalt psychologists used the terms “function” and “structure” when they presented their view of perception. However, it seems that these two terms are merely aspects of each other; the same thing is envisaged first from a static and then from a dynamic point of view. Structure is the form of an activity, a something moving, or a something that changes; function is the activity of the form, the moving or changing of the thing. Structure and function have opposite but mutually dependent meanings. The same understanding can also be found in Cassirer’s work when he discussed the idea of constancy and change in knowledge in his functional-relational account. He argued that the functional activity of thought finds its true application in structural meaning and that it is a dynamic act leading towards constructive knowledge of particulars. He assumed that there should be a mutual interdependence between particulars and functions, or between change and constancy:

A different view results, according as we choose our standpoint at the conceived limit or within the series and its progress; yet each of the two aspects requires the other for its completion. The change is directed toward a *constancy*, while the constancy, on the other hand, can only come to consciousness in the *change*. There is no act of knowledge, which is not directed on some fixed content of relations as its real object; while, on the other hand, this content can only be verified and comprehended in acts of knowledge. (Cassirer, 1923:315-316).

The second meaning of constancy refers to the fact that the phenomenological image will be constant across changes in the retinal image as in the case of the size and height perception. Although the retinal image representing the size of the external object will be constant even though there are differences between the external object and its retinal image, the mind goes beyond the retinal image and retains the real size of the object. A clear example of this can be seen in the experiment called “The Ames room”. In this experiment an observer watches two objects of the same size standing in two corners of the room. The room has been designed to mislead the observer when he it views from a particular position outside the room.

In this experiment, two retinal images represent the size of the same object because of the setting of the room. The question is whether or not the retinal image reflects the size of the object as perceived. If the answer is yes, this supports the empiricist’s view of the hypothesis of constancy. If the answer is negative, thus supports the Gestalt version of

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the constancy hypothesis. The Gestaltists pointed out that the mind goes beyond the object represented by the retinal image and tends to give a constant size to the object displayed in the room. The mind neither supports the retinal image representing the object as giant nor does support it as very small object. The mind maintains the phenomenological image by ascribing constant size to the object displayed in the room even though this phenomenological image is not presented in perceptual situation. The mind maintains this phenomenological image as constant to distinguish it from that of illusory image.

Another example that may reinforce our view regarding the relative constancy of spatial perception is the example of the three cylinders (Figure6-5).



Figure (6-5)

Although these cylinders have the same size, they seem to be different in size. The apparent difference in size represented in the retinal image, depends on the distance between each cylinder and the distance between the observer and the cylinders. Although the retinal image shows that the three cylinders are differently spaced, the observer tends to give a constant size form to the apparent size as he perceived it. He tends to ascribe a constant size to the perceived cylinders and goes beyond the apparent size reflected by the retinal image. This understanding illustrates the Gestalt psychologists' were against the theme that one- to- one relationship presented by the retinal image to represent things as given in perceptual experience. Rather, they suggested one- to many- relationship where the phenomenological image can variously represent form as constructed not things as given.

This understanding of the spatial properties of represented forms has been understood by the Gestaltists as an objection to the hypothesis of constancy claimed by empiricists

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as a way for understanding perceptual space. We reach the conclusion that perceptual space is a theme of how to construct geometrical forms represented by the phenomenological image and hence the nature of the characteristics of the forms are relative and constructive, not just independent properties that are given even under different perceptual situations.

6-4 Gestalt and the Structuralism of Two and Three Dimensional Space

The Gestalt psychologists were motivated by a philosophical conviction that perception generally, and the visual perception of space in particular, must be centrally organized by a dynamic process. The elements of this dynamic process are invariance, transformation, rotation and whole-part interactions. From these general features, we can trace these elements of the dynamic process while we are discussing spatial perception. Therefore the present section will be devoted to discussing the structural aspects of two and three dimensional perceptual space. Koffka pointed out how spatial figures represented in the retinal image can be interpreted as 2D or 3D forms in the phenomenological image:

Koffka's treatment of the perception of three-dimensional space may be cited as illustrating the dynamics of organization. The dimension of distance or depth, producing an appearance of solidity in an object, is obviously not given by the retinal pattern, for the latter is only bidimensional. It is a property of the field whose physiological existence must be inferred to be in the brain. And the field has not two dimensions, but three. A drawing of a hollow, or outline, cube is seen clearly and inescapably in three dimensions, not as twelve lines on a single plane. The third dimension is produced by the fact that "rotating" an angle in this dimension is the simplest method of perceiving it. "Flopping it over" in a third dimension of space requires less action than twisting the figure around and moving it up and down in a bidimensional plane. (Allport, 1955:119).

Consistent with the general themes of Gestalt psychology, Koffka confirms that the form involves a constructive meaning that leads us to represent the twelve lines not as twelve separated lines, rather as 3D form. This understanding led Koffka to reject the empiricist version of the constancy hypothesis. This hypothesis states that geometrical figures represented by the retinal image will have independent properties that remain unchangeable under any kind of changes taking place in perceptual experience. For

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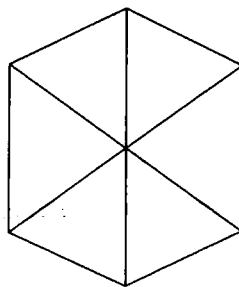
instance, the circle presented by the retinal image will always be perceived as a circle regardless any kind of changes taken place in situation. However, the Gestaltists claimed that the form represented in the phenomenological image can be represented differently as 2D or 3D depending on the kind of transformation taking place in the perceptual situation. The same example of the circle as a figure, can be represented in the phenomenological image as 2D as an ellipse or 3D as a sphere or as a cylinder. The structuralism version of the Gestaltists emerges from the distinction between retinal and phenomenological image and the construction of the contents of the form differently in respect of the transformation taking place by dynamic processes. Let us trace that meaning by an example of a hexagon as given by the Gestaltists. As a matter of fact, the structural aspect of spatial perception can be broken into two areas.

1- Two- dimensional space; in this case one is concerned with the fact that he can locate things to the left or right and up or down.

2- Three- dimensional space; one also here can locate the distance of an object away or close to him i.e. depth. The perception of three - dimensional space is concerned with the perception of the depth such as cube or the volume like a cylinder.

Therefore we will try here to reveal the structural aspect of both two and three-dimensional space as it has been applied by the Gestalt psychologists. As a matter of fact the Gestalt psychologists are conspicuously concerned with the spatial organization of two- and three -dimensional forms of perceptual space. They were more concerned with the question of how can the contents of a form can be represented as two or three dimensional space under a process of transformation. (Boothe, 2002: 225).

Let us examine some examples that show the possibility of representing the same contents of a form differently under changes of the phenomenological image. The following figure (6-6) allows two or three dimensional perception.



(Figure6-6)

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Indeed, this figure is represented in the retinal image as 2D figure as a hexagon. However, the same figure can be represented differently in the phenomenological image even if no changes in the stimuli hit the eye nerve. The same content of the figure under a process of rotation can be represented as 3D form as a Cube with depth. The relationships between the contents of the form remain unchanged when the form is invariant under the process of rotation. It is the role of understanding that brings us to find various arrangements of the contents of the figure and fit them under appropriate structures. It is impossible to perceive these two forms as a hexagon and a cube simultaneously. The determination of which form will dominate over the other is decided by the constancy of the frame of reference which determines the sort of arrangement of the contents and the relationships between them.

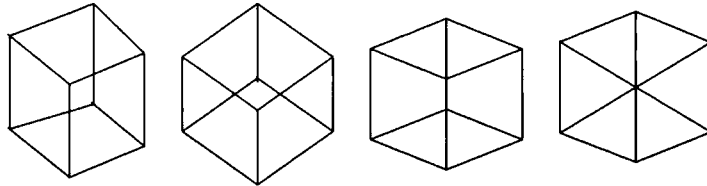
The stimulus of figure 6-6 is more often than not interpreted by subjects as a two dimensional regular hexagon. It can also of course, be interpreted as three dimensional cube with front face ABGF or a cube with front face CDEG.... The scanner, starting at A would discover the vertical line AB, but not horizontal line. Further, it would discover the line AGD extending across the figure. It would discover that each of the three lines, CF, AD, and BE are axes of bilateral symmetry and that the six triangles about G are equilateral and equal. Hence, the figures interpreted as two dimensional, would be composed of symmetrically disposed simple subfigures. Any attempt to reinterpret the stimulus in three dimensions would destroy a number of the properties. The six triangles no longer exist in the three dimensional figure; the halves of the six diameters become distinct line segments parallel but not collinear. (Barenfeld, 1979:358-359).

This example clearly reflects the Gestalt psychologists' view of transformations that take place in visual perceptual space. It also shows that the figural transformation of two- dimensional space to three- dimensional depends on a structural form that remains invariant during these perceptual transformations.

There are the experiments of both Hochberg and McAlister (1953) and Hochberg and Brooks (1960) in addition to these experiments. They presented to the subjects some geometrical figures and sought to analyze the responses of the subjects regarding whether or not there are changes taking place in their spatial perception or not. Both Hochberg and McAlister showed the geometrical figures (fig 6-7) to observers and asked them to say whether these geometrical figures were perceived as 2D or 3D. The

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experiment showed that a high percentage of observers stated that they firstly perceived these geometrical figures as 2D and later on they reported that the 2D figures are also represented as 3D forms with depth. (Vernon, 1970: 42 see also Bruce, & Green,1992:115-116).



(Fig 6-7)

It is not the mere presentation of the retinal image of the figure, rather the dynamic process leads the phenomenological image to represent possible forms:

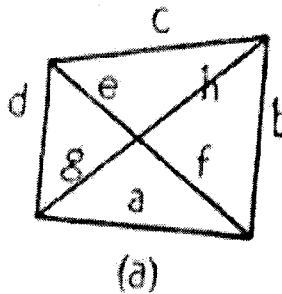
The traditional treatment of this factor consists in describing the facts without any attempt at going behind them. Corresponding points are defined as points which when simultaneously stimulated give rise to the perception of one object, or as points the stimulation of which gives rise to the perception of one and the same direction....It is clear that a psychology such as we are trying to develop cannot be satisfied with such a state of affairs. For this psychology the visual world is a product of organization in the psychophysical field, and it attempts to understand the process of this organization and the factors which determine it. The facts of retinal disparity, as usually stated, are facts of geometry. What we require are facts of dynamics. (Koffka, 1935: 266).

Koffka rejected the idea of “thingness” as a property that we ascribe to retinal figures as we ascribe thingness to both geographical and physical objects (Koffka,1935: 275). Koffka, like the other Gestaltists, claimed that the property of “thingness” implied by the empiricist and the whole purely empiristic theory, is bound to run in a vicious circle (Koffka,1935: 305). The Gestaltists showed that visual perceptual space is structural space not geographical or physical space. Visual perceptual space has to be understood in light of the dynamic processes of our mind.

Here another example was raised by Koffka explaining how phenomenological image represents a 2D figure as a 3D form under a dynamic process of transformation. He

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demonstrates that we can perceive a figure as an “uneven rectangle with diagonals” as 2D and then as 3D tetrahedron (figure 6-8) after dynamic process of rotation.



(Figure6-8)

At first, the “composition” present is (a, b, c, d): (e, f), (g, h), but after the conversion into the third-dimension, one sees [a, d, (e+ f)]; [a, b, (g+ h)]; [d, c, (h+ g)]; [b, c, (e+ f)]. It is psychologically impossible to maintain the former “togetherness” and realize a solid, and the converse is equally true. (Hartmann, 1935:106).

The importance of the Gestalt psychology regarding visual perceptual space is to confirm that visual space is constructed and not just simply represented by the retinal image. In addition, the representation of visual perceptual space is determined by the perceiver’s frame of reference that remains invariant under the transformational processes (Humphrey, & Jolicoeur,1998:109-111).

That is why Cassirer adjusted their views and explained it in the light of group theory. He saw that the retinal image constructs holistic forms that arrange the relationship between the structure and its contents or between as a version of his discussion of the relationship between the universal and the particulars. According to Cassirer’s view, the Gestaltists’s version of structuralism is explicable under the main theme of Functional-Relational thought as an approach and shows the process of constructing the object of knowledge entirely differs from substantial thought.

I claim that Cassirer’s thought influenced the Gestaltists’ literature and the way they formulated their theoretical approaches. Kurt Lewin referred several times to Cassirer’s ideas in his books and he wrote an article *Cassirer’s Philosophy of Science and the Social Sciences* in 1949. *Philosophy of Ernst Cassirer* in which he discussed some ideas of Cassirer’s theoretical approach and how it is applicable to social psychology. We can understand Cassirer’s Functional- Relational thought and the Gestaltists’ Structural

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Organization and Dynamic Process as two versions of one general theme of how we construct the object of knowledge in the light of relational orders of our understanding. There is some evidence that show the connection between Cassirer's and the Gestaltists' account of visual perceptual space.

For example, in his *Principles of Topological Psychology* Kurt Lewin quotes a paragraph from Cassirer's *Substance and Function*, where Lewin defined the concept of Functional- Relational thought, Lewin referred to Cassirer who supported the concept of dynamic construction over entities in physical theories (Lewin, 1936: 82).

Lewin picked up this understanding and applied it to psychology by claiming that the dynamic organizational process and the structures that it implies is not a given fact grasped in experience, rather the problems and the issues that concern psychology generally and social psychology specifically, need to be re-formulated not in light of given, but in light of the dynamic organizational laws:

The dynamic structure of a situation is not an immediately given fact. As we have said the complete representation of even one given situation would presuppose the solution of all psychological problems and the knowledge of all psychological laws. For scientific research the difficulties begin as soon as one tries to represent a "given" situation. A complete representation of one situation would mean that the whole task of psychology is completed. The representation can be made only step by step and its progress must be parallel to the investigation of the dynamic laws. (Lewin, 1936:82).

What Lewin meant here was to clarify the fact that dynamic structure, as a constructive whole, is not simply given but is constructively represented through a dynamic process as we shall explain when we discuss his account on social forces and how they organize social situations represented as a whole.

In addition, Koffka sought to answer the question of why things look as they do by making the distinction between the retinal and the phenomenological image. Koffka pointed that retinal image represents things as they are given in experience but fails to show how we perceive the same object differently even though there was no change in the parts composing the object. The epistemological error of empiricism, Koffka argues, is to ignore the power of the structural whole that organizes the relations between the parts. It is misleading to speak of pictures of outside things being represented by our retina as on a photographic plate, because this view ignores the dynamic laws that organize the elements of perceptual experience (Koffka, 1935:97-98).

Chapter Six: Gestalt and the Structural Aspect of Visual Space

How do we judge the shapes and estimate the dimensions of the environment we live in? For a man , the very essence of environmental shapes and dimensions is that they are successively transformed on the retina. If these locomotor transformations all yield perceptions of the same objects why could not other transformations yield the perception of all possible different visual forms? Certain regular transformations go with a perception of the same shape. They are related to the geometry of perspective and parallax. Certain other transformations, not experienced as continuous during locomotion, go with the perception of different shapes....the concepts of modern geometry according to Cassirer derive their precision and true universality only from the fact that the intuited particular figures are not considered as pre-given and rigid, but rather as a kind of plastic material capable of being moulded into the most varied forms. (Gibson, 1950:192-193).

Lewin shares not only Cassirer's philosophical perspective on Relational- Functional thought, but also his terminology. For example, Lewin ascribes the characteristics of plasticity and elasticity to structural organizations where changes take place in social behaviours under a definite invariant. (Lewin, K.1936.82).

To sum up, the common factor between Cassirer, who applied functional relational thought to space and the Gestaltists who applied organizational laws of configuration to space, lie in the concepts of invariance and transformation. Both sides understood space whether geometrical or perceptual as a system that implies certain orders of arranging and grouping the relationships between the elements of the structure. Space as a system implies a constructive process which aims to give different forms to the contents. This is the constructive method that the Gestaltists used and applied to their view of psychology. This constructive view is also applied to their view on colour perception as we shall discuss now in the next chapter.

Gestalt and the Structural Aspect of Colour Perception

7-1 Introduction

The aim of this chapter is to describe the structural aspects of the Gestalt theory of colour perception. Therefore in this chapter our aim is to show that the Gestaltists based their account of colour perception on structuralism. By claiming that, we will distinguish their view from two other accounts on colour perception which are the layman's account and the Physiologists' account of colour perception. We will address also the relationship between Cassirer's invariance theory of experience and the Gestaltists view on colour perception and see how consistently their views matches with Cassirer's view regarding space and colour perception. By examining the perceptual experience of colour, we shall be able to see how the Gestaltists were structuralists by discussing the difference they made between retinal and phenomenological image.

7-2 *Three Accounts of Colour Perception*

My aim throughout this section is to analyse perceptual experience of colour and to see how the Gestalt psychologists understood it. My goal here is to explain the structural account of the Gestalt psychologists by shedding light on the aspects of their structuralism regarding colour experience. Therefore I will seek to find the role of colour experience and the function it performs in the perceptual field. I will also aim to find whether or not it is linked with their view regarding the experience of motion and space. Thus, we can see whether the Gestalt psychologists were consistent when they applied their theoretical schemes to colour perception.

It is difficult to imagine perceiving any external object that is colourless. Colour is an essential part of our normal perceptual experience. It is also true that colour affects our ability to differentiate objects: Therefore we can define colour as follows:

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Any noticeable difference between two fields of luminance other than spatial, temporal, or intensity variation is due to difference in colour. (Haber, & Hershenson, 1980: 91).

According to that definition, there is a strong relationship between perceiving coloured objects and the intensity of light reflected on the surface of the object. This view has been maintained by different physicists such as Newton in the *Optics* where he claimed that the human eye often cannot distinguish between colours formed by different combinations of light. For example, if we have different lights such as red and green with different angles of refraction, then we will have the colour sensation yellow and the latter is indistinguishable from the sensation produced by a pure yellow light (Nathans, 1997:249).

An important question is whether the perceived object has an independent colour which is unchangeable within the changes of light intensity or whether the perceived object has only “apparent colour” that is recognized under certain conditions of illumination. It is the same claim regarding the distinction between retinal image and phenomenological image.

The next question that needs to be addressed is how the essence of colour perceived can be defined and how we can perceive coloured objects.

The essence of colour can be discussed by three different accounts of the nature of colour. These accounts are; the layman’s or simple account, the physiological account and finally the logical account. The first two accounts have been discussed by (Tye, 2000) and the third account is my description of the Gestalt Psychologists view on colour perception as a way to distinguish their view from both layman from one side and physiologists either they were nativists or empiricists, as we shall discuss it during this chapter.

7-3 The Layman's Account of Colour Perception

The layman believes that the world is as it appears to be represented by sense organs. He ascribes independent colour characteristics to the external objects. He also believes

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that the external objects have colour in themselves: the greenness of grass, the whiteness of snow and the blackness of coal:

Objects do not typically appear to change their colours during the day as the sunlight changes. Grass in the early morning looks to have the same colour as it does at midday or late in the afternoon, even though the light is very different. Nor does it make much difference to the perceived colours of objects- plants, for example- when they are moved from outdoors to a setting of illumination by incandescent lamps. Moreover, wearing sunglasses has little effect on the colours objects appear to have. (Tye, 2000: 147).

This view had been criticised by some physiologists like Helmholtz and Hering who explained the nature of colour perception under certain changes of illuminations. For example, Hering calls the view, which ascribes unchanged colour to the external objects, as an “*uninstructed view*” of colour perception. Hering came to the conclusion that the uninstructed person takes the green of a leaf as a fixed property of the leaf.

Therefore it was important for Hering to distinguish in the layman’s view of colour two aspects of colour. Firstly the idea that colour is an independent property of the object is “*real colour*” and secondly colour as it appears under changes of illuminations which he calls “*incidental colour*”. The uninstructed person believes that the perceived colour of an object remains fixed even under changes of illuminations.

The layman always reduces the objects to their real colour. Hering explains that the layman cannot distinguish between the colour as independent and the colour as appears under different light intensity:

The layman, as we have already said, is convinced that external objects have intrinsic colors, that snow is white, soot is black, and gold is yellow. He ascribes to these colors an existence that is independent of the eye, designates them as the real colors of the objects in question, and distinguishes them from the incidental colors that the same objects may show under unusual circumstance, for example, in illumination that is inadequate or that deviates strongly from ordinary daylight. The red of the mountain peak in the alpenglow, the pallor of a face that is illuminated by sodium light, the colored spot on a floor when sunlight falls on it through a colored window pane, are such incidental colors which we relate to the momentary nature of the illumination and do not take as properties of the objects in question. (Hering, 1964: 6-7).

In fact, we can see that the layman’s account of colour perception is too simple to the extent that it fails to provide a phenomenological understanding of the nature of colour.

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If we take a brief look at the layman's account, we can see it can be understood in the light of the following category. He ascribes "*the hypothesis of constancy*" to colour perception: For example, the hypothesis of constancy, as we explained before, ascribes independent properties to the given. This category represents a form of realism with regard to layman's view on colour perception.

This view led the layman to the belief that physical objects have permanent colour qualities and remain unchangeable even if tremendous changes have taken place in the physical world. The second reason is that the layman could not take experience a step further to its critical meaning, rather he limits himself to its simple meaning that revolves around the sensory qualities of external objects. He could not capture the constructive meanings implied in experience. Therefore, another approach that gives different meanings to perceptual experience will be investigated now.

7-4 The Physiological Account of Colour Perception

The physiological account interprets the colour of objects through the relationship between physical stimulus and the brain and optic nerve. The physiologists of the nineteenth century agreed that the stimulation of any given nerve attached to a sense-organ produces its own experiences. Different physiologists like Johannes Muller, Ewald Hering and Hermann Von Helmholtz used their physiological background to provide an explanation of colour perception via the nerves of the retina. Let us examine some of their claims regarding the possibility of explaining the changes of colour perception through the workings of the nervous system. Before discussing these physiological attempts, it is important to note that there is variety in the physiologists's analyses regarding colour perception. Although these attempts share the same starting point of taking the nervous system as a model for their explanations, we find that each of the physiologists has a different interpretation of the correlation between retina nerves and how they relate to the nervous system.

It is important to understand the differences between those physiologists, who are divided into two groups. The nativists argue that there exist some modes of functions that are present from the moment of birth. The empiricists, on the contrary, argue that

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any explanation of physiological process appeals to learning and practice. According to that distinction, we are going to analyse colour perception.

Johannes Muller (1801-1858) is one of the nineteenth century pioneers who applied an empirical- physiological view to colour perception. Muller claimed that the senses, by virtue of the peculiar properties of their nerves, acquaint us with the state of our body. Although sensations are important because they inform us of the qualities and changes of the external nature, the nature of the sensation is determined by the characteristics of what he calls “specific energies” of the sensory nerves. According to Muller’s doctrine of specific nerve energies, the experience of colour perception depends upon the stimulation of the optic nerve. Muller indicates that sensory organs are not mirrors of nature, and sense experience is not a direct reflection of the physical properties of the external environment. We do not sense the qualities of nature. Rather, experience responds to the qualities as fixed by the physiological make-up of the affected sense (Muller, 1842)

One of the most significant difficulties facing Muller’s theory of specific nerve energies as applied to colour perception is the idea that the eye has a mechanism and the ability to distinguish between sensory qualities. Let us suppose that a normal man can distinguish between thousands of different hues; this does not mean that each of these thousands of different kinds of sensory qualities has its own receiving mechanism in the eye (Kaufman, 1974:158-159).

Ewald Hering (1834-1918) is one of the most important physiologists of the nineteenth and early twentieth century who became famous for his experiments on vision, the nature of brightness and colour constancy. In 1908 he published his study of what he called “*memory colour*” where he gave a new meaning to the concept of memory colour, confirming the relativity of colour perception. He indicated that colour perception implies a relativistic understanding that contrasts with layman’s view that coloured objects have independent properties. It is also important to view Hering’s analysis of colour perception through his nativism.

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Hering sought to go beyond Muller's view by reducing colour perception to definite parts of the nervous system. Although Hering improved on Muller's theory of colour perception, he still shares with Muller the epistemological view of nativism. Both Muller and Hering believed that when the sensory nerve is stimulated, it leads to the sensation of a unique quality such as light, sound and so on. They believe that such events are innately organized and not acquired by experience and learning.

For Muller, the founder of empirical physiology, colour perception is due essentially to the optic nerve and the activities of the brain.

Being a physiologist who maintains a nativistic view, Hering believes that the organism has innate properties determining the ways in which it will perceive the world and gain insights into its detail.

Hering applied this view to his theory of four colour theory. I would like, before I discuss that theory, to throw some light on Hering's view regarding the movement of the eye and its function. Given his nativistic understanding, Hering rejects the idea that the two eyes and the related pathways of the visual system are separate independent systems that become related only as a result of visual experience. On the contrary, he argues that the two eyes are co-ordinated and present a unitary visual impression. For Hering, the co-ordination of the movements in the two eyes depends upon an inborn arrangement, and not upon exercise. Therefore, in contrast to the empiricists, Hering considers the movements of the two eyes taken together as constituting a single organ. This view rejects Helmholtz's view that argues that the movement of the two eyes is a result of experience and practice. (Hering, Trans by Hurvich & Jameson, 1964: 271-278).

Hering extended his nativistic view by applying it to his theory of colour perception which was later called Hering's four-colour theory. He argued that there are relations between sensations and the retinal nerves. According to him, perception of colour takes place when the visual substances on the retina are physically stimulated. Based on his physiological view, he proposed, apart from white and black, four sensations arranged in two opposing pairs; yellow/blue and red/green. Hering calls white and black veiled

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or masked chromatic colour, while the second set of chromatic colors that do not show such veiling he calls unmasked chromatic colours (Hering, 1964: 41-42).

Each pair of sensations includes two opposite actions; *katabolism* or assimilation and *anabolism* or dissimilation. These two opposite actions of light reflect on the visual substances in the retina:

There must therefore be a receptive visual substance which can undergo a positive change (assimilation) when white is seen, and a negative change (dissimilation) when black is seen. When grey is seen there is equilibrium in the black- white substance. According to Hering there are two other substances, one which by assimilation produces the sensation of red and by dissimilation the sensation of green (or vice versa), and the other which produces on assimilation the sensation of yellow and dissimilation the sensation of blue (or vice versa) when there is equilibrium in the two latter substances no colour is seen. (Crone,1999:166).

According to Hering, colour perception can be understood in the light of the reflection of the two opposite actions on the visual substance in the retina. He suggested that the four primary hues are in fact opposing hues, whose opposition indicates that these hue sensations are the product of antagonistic neural processes.

The four colour theory of perception reflects Hering's belief that human perception has some innate components. Therefore, he considers the limits of perception to be related directly to innately determined physiological processes.

Being a nativist, Hering supports the idea of colour relativity which means that the colour of a perceived object varies according to the intensity of illumination. For example, he used the term "*memory colour*" to refer to the relativity of perception. He sees that the memory colour of an object does not need to be strictly fixed, rather it varies according to changes in the light intensity. For Hering, relativity of colour means incidental colour because he believes that objects do not have independent and hence fixed colours:

For the color in which we have most consistently seen an external object is impressed indelibly on our memory and becomes a fixed property of the memory image. What the layman calls the real color of an object is a color of the object that has become fixed, as it were, in his memory; I should like to call it the *memory color* of the object. (Hering, 1964: 7).

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Hering confirmed the relative nature of colour perception by designing various experiments to show how we perceive colour of objects under different intensity of light. He explains that the colour of an object varies in respect to changes in the light. Hering used a simple apparatus to make that point.

Imagine a box open toward the window so that sky light can fall down on a glass plate in the box. The glass plate can be rotated about a horizontal axis and it is covered with colored, for example orange paper. On the top panel of the box is a stiff, opaque sheet covered with white paper and containing a round hole on which, when needed, a dark viewing tube can be placed. If the tube and the glass plate are removed, then one sees from above, a circular orange- coloured field in the plane of the white paper. Now if the glass plate is rotated toward the back, then the orange is increasingly veiled with black, and becomes first light brown, then dark brown, and finally brownish black. If one replaces the viewing tube without changing anything else, then through the tube one immediately sees once more a glowing orange, which is transformed just as quickly again into brownish black when the viewing tube is again removed (Hering, from Hurvich, 1964:7-9).

Hering explained colour perception showing the relative nature of colour when it is transformed in respect to the light intensity. Helmholtz shared Hering's relativistic approach to colour perception but took empiricism rather than nativism as a model for explaining the processes on which colour perception depend.

Helmholtz shared with the physiologists of his time some ideas concerning colour perception. Helmholtz set up a theory explaining the perceptual colour of the external objects. Helmholtz argued that there are three kinds of nerve-fibres in the eye producing three kinds of colour sensation when stimulated. For example, one fibre produces the sensation of blue, another the sensation of red and a third the sensation of green (Kaufman, 1974:159-160). Helmholtz differs in his account of colour perception from both Muller and Hering. He explains colour perception in the light of experience and learning in contrast to the nativism of Muller and Hering. This distinction between Helmholtz and Hering starts from their separate attempts to justify eye movement. Helmholtz argued that the necessity of moving both eyes together and the regularity of this connection is a result of practice. The nativist explains perceptual experience of

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colour or space by assuming the existence of intuitions or principles that are innately determined. However, being an empiricist, Helmholtz argues that human perception is justified not by innately determined physiological processes, but by learning and practice. What seems to be intuitive is in fact learned and acquired through experience and deduced through unconscious inference. For instance, Helmholtz believes that perceptual space and even Euclidean geometrical axioms are not the product of intuition, but are a product of experience that we interpret via unconscious inference.

Helmholtz and Hering disagreed about whether inherited organization within the brain structures what is perceived. Helmholtz argued that perceptual experience is reconstituted anew in each person, that is, learned by the way the mind forms elementary sensations into a unity. He argued, to a degree influenced by Kant, that perceptions involve central psychological processes in addition to the sensory data of the particular experience, and he called the mental process "unconscious inference". He believed, for instance, that the visual perception of depth is an acquired perception achieved by mental unconscious inference about sensory information provided by binocular vision (in which the two eyeballs move slightly in order to focus on objects at different distances). His position was therefore described as empiricist. (Smith, 1997: 503).

Helmholtz's view can be understood in another way if we place him in the circle of structuralists. Despite the fact that Helmholtz was an empiricist, he was also a Neo-Kantian. Helmholtz sought to interpret Kantian transcendental principles in the light of physiological knowledge and along the general lines of empiricism. It is true that the Neo-Kantians had been influenced by Kant's philosophical system, but at the same time they changed that system and reinterpreted it in a way that allowed them to include the new developments that had taken place in the nineteenth century. The examples of these developments have been discussed in Chapter Two, section (2-2). Although Helmholtz was a Neo-Kantian, he was never far from his primary roots in Kant. Helmholtz believed in systematic unity and construction, the ideas that form structuralism. Helmholtz sought to find a base in the mind that can explain the changes that take place in sensation when illumination is changed.

The structuralism of Helmholtz was expressed by Cassirer (1944) when he claimed that Helmholtz was a pioneer in his application of the concept of group to mathematics, which aimed to explore the relative properties of mathematical figures when they are

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organized or constructed according to a certain class or group. Helmholtz also applied that thought to the field of perception. Helmholtz believed that experience is not just a mere aggregate of chaotic visual images, but that a rule must be presupposed by which these images are organized. Helmholtz rejected the idea that what we perceive is determined by the retina but he argued that another structural element is needed to understand how we perceive space, shape and colour:

The mere succession of the visual images, no matter how many we assume, would never of itself give us the presentation of a corporeal object, if the thought of a rule were not added, by which a certain order and position is ascribed to each in the total complex. In this sense, the presentation of the stereometric form plays “the role of a concept compounded from a great series of sense perceptions, which however, could not necessarily be constructed in verbally expressible definitions, such as the geometrician uses, but only through the living presentation of the law, according to which the perspective images follow each other”. This ordering by a concept means, however, that the various elements do not lie alongside of each other like the parts of an aggregate, but that we estimate each of them according to its *systematic* significance. (Helmholtz, 1896:428, Quoted from Cassirer, 1923: 289).

Helmholtz similarly understands perception of colour in the light of the dualism between the conditions that determine perceptual experience and the particulars we perceive under these conditions. Perceived colour is determined by the conditions of illumination. This led Helmholtz to distinguish between sensation and perception. He used the term “sensation” to refer to the fact that experience is chaotic because it does not submit to specific orders of organization. In that sense, experience provided by sensation is lawfulness. Meanwhile, he used the term “perception” to refer to the fact that experience is organized and submitted to orders. Experience provided by perception is lawful and organized by orders. By distinguishing between sensation and perception, Helmholtz gives perceptual experience a significance which implies a judgement based on inference while sensation does not imply any kind of inference. According to Helmholtz, the judgement included in perception justifies the apparent constancy of colour. Helmholtz was eager to find an answer to the question of how we can interpret our sensations regarding colour when the illumination is changed. He gave the answer in his *Treatise On Physiological Optics*:

Seeing as we do the same coloured objects under... different illuminations, we learn to construct, in spite of the differences in illumination, a correct idea of the colours of the objects, i.e., we learn to

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judge how such an object would appear in white illumination, and since it is only the permanent colour of the object which interests us to become quite unconscious of the individual sensation upon which our judgement is based.

A grey paper in sunshine may be brighter than a white paper in shadow; nevertheless we see the first as grey and the second as white; because we know very well that if the white sheet were placed in sunshine it would appear much brighter than the grey does at present. (Helmholtz, 1925 Vol II: 243 Quoted from Katz, 1935: 260-161).

Helmholtz distinguishes between apparent colour and constant colour. The apparent colour is the colour that changes when the condition of illumination changes. This fact can be grasped by considering daily experience where the apparent colour of perceived objects varies with changes of illumination. Constant colour does not mean, according to Helmholtz, that an object has an independent property of colour, but refers to the task of judging the colour of an object under the continuous changes of illumination and this will be easy due to practice and learning. Practice teaches us to judge the colour of an object even under changes of illumination. Therefore we do not have difficulty in judging that white paper in full moonlight is still brighter than grey or black paper in day-light. We ascribe to the white paper a constant colour even though it appears darker than the grey paper in day- light.

In his empirical physiology, Helmholtz opens the way for the Gestaltists to set up their structuralism regarding colour perception by forming colour perception in the light of that dualism between orders organizing perceptual experience and coloured objects.

7-5 The logical Account of Colour Perception

The third account of colour perception is the logical account. The Gestalt school is representative of that approach. This logical account has two main features; it opposes both nativism and empiricism concerning colour perception, and attributes what is unchangeable to what is changeable. This logical account is nothing more than the Functional-Relational thought expressed by Cassirer and applied in the psychology of perception by the Gestaltists. Koffka and Kohler both objected to nativism and empiricism by claiming that individuals do not react to local stimuli as independent events. Rather, the organism responds to the pattern of stimuli to which it is exposed.

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They argued that perceptual experience cannot be explained by either inborn functions or products of learning. They adopted an approach between these two views.

The Gestaltists argued that to explain any perceptual action, inborn capacities are needed, however they cannot be applied deliberately as claimed by the nativists. These inborn capacities need to be activated and this activation takes place through dynamic processes like rotation, projection and transformation as we explained when we discussed perceptual space. For example, phenomenological images are presented through dynamic processes to activate these inborn capacities. The Gestaltist's concept of insight, as will be explained in Chapter Eight, presented a phenomenological image of the object represented immediately without any effort. But to present different and possible phenomenological images of the same object, insight is not enough; we need a dynamic activity to activate these inborn capacities.

They argued that every capacity is the result of the constant co-operation of both inner and outer conditions of development. William Stern is one of the Gestaltists who solved the clash between nativism and empiricism through his "Convergence Theory". Stern argued in his 1914 article "Psychology of Early Childhood" that perceptual experience is achieved by a co-operation between inner and outer conditions.

Both Koffka and Kohler agreed with Stern's idea of convergence to solve the clash between nativism and empiricism, however they rejected the technical terms like "within from without" Stern used because they seemed to the Gestaltists as ambiguous and meaningless. Until 1928, Koffka only criticised Stern's theory of convergence without suggesting an alternative. However, in 1930 Kohler replaced Stern's terms with his own. He no longer called the dynamic interaction between intuition and experience convergence, but "the unitary process" or he sometimes calls it the dynamic process. He argued that this unitary process has an important characteristic: it is a functional whole which has an orderly internal structure. The Gestaltists do not apply that dynamic process to colour but they extend it to be applied to different aspects of psychology as an alternative to both nativism and empiricism. Therefore, they applied that understanding to different concepts of perception:

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It is quite clear to us that constancy of brightness and constancy of size are, as facts, incompatible with the assumptions of the machine theory; for in both cases sensory experience is surely not determined by corresponding local stimuli alone.... In the meantime, animal psychology has offered strong evidence against these explanations, it must now be admitted that neither the empiristic nor the nativistic assumptions can be right. Thus we must try to find a kind of function which is orderly and yet not entirely constrained by either inherited or acquired arrangements. If such an alternative exists, we shall have to apply it also to other observations, such as the constancies of shape, speed, location, and so forth.... This means, of course, that the alternative between nativistic and empiristic assumptions must be quite generally mistaken. (Kohler, 1947: 117).

The Gestaltists showed that sensory experience cannot be explained or justified through the machine theory of the nervous system. On the contrary, they argued that sensory experience can be explained by dynamic factors rather than anatomical conditions. The sensory experience is not a mere mosaic or additive aggregation of facts, but implies structural and dynamic elements, or what we call non- physical elements. Perceptual experience always presupposes some structural properties that are not involved in the constituents of experience. For instance, Kohler gives the following example to confirm that perceptual experience is not a response to local stimuli. If we take a glass of water in which soap is dissolved, such a liquid is defined by such adjectives as "dim" or "turbid". Now, if we look at it through a little hole made in a piece of cardboard, one will see the hole filled with a certain grey hue (possibly a bit bluish or reddish), but the quality of dimness or turbidity will have disappeared (Hartmann, 1935: 123).

The properties of colour and brightness do not depend on local stimuli as represented by the retinal image; rather they are represented on the phenomenological image in different form and hence different colour. The general aim of the Gestaltists is to show the representation of colour on the phenomenological image differs when it displays under different intensity of illumination. The Gestaltists showed that there is a transformation that takes place leading the original colour of an object to be represented differently in respect to this transformation. The shift from retinal image to phenomenological image takes place through a dynamic process by which a different colour will be ascribed to the object. This apparent object will remain the dominating colour unless another change happens in the perceptual situation.

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The Gestaltists confirmed the idea that the properties of visual objects such as brightness and colour are properties that depend upon more than local uniform stimulation. The colour as represented on phenomenological image reflects that fact compared to the retinal image. The Gestaltists designed different experiments that show the possibility of displaying different colour on the phenomenological image although the conditions of the experiment are fixed. For example, they designed an experiment using nine spots shown in figure(7-1) which allows one to perceive either a yellow plus sign (+) or a blue-green cross (X). The experiment has designed where the middle yellow-green circle can be belonged to either pattern. In this case, the retinal image will represent two different figures with two different colours. It represents yellow cross (+) or blue green cross(X). Rather, the phenomenological image represents the middle circle as a yellow circle and looks yellow if perceived as part of a plus-sign comprised of the other yellow and it will be represented as greenish if it is perceived as of an X sign (Hartmann, 1935;123).

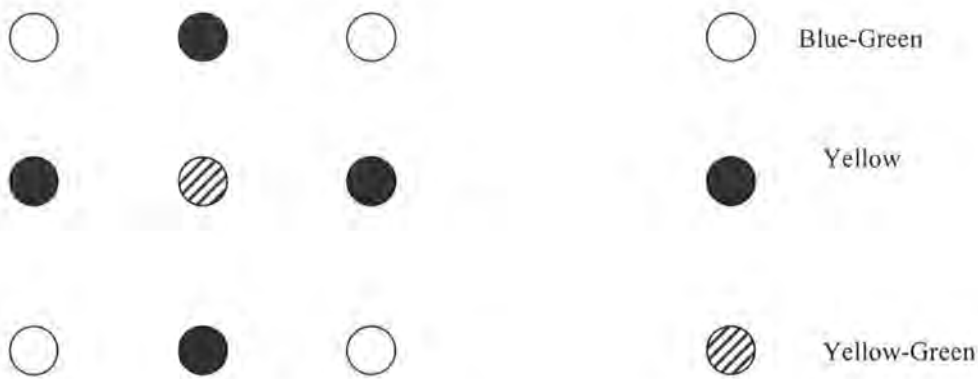


Figure (7-1)

This understanding led the Gestaltists to impose the functional dynamic approach as a way of representing sensory impressions or the retinal images as organized differently within a structural whole. These dynamic functional activities of understanding transform certain colours in the retinal image into different colours in the phenomenological image. Now the second aspect of that logical account needs to be discussed.

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Cassirer set up his view on colour perception depending on the Gestaltists's experiments on colour perception. He indicated that colour perception is an investigation about construction of forms rather than independent properties of objects. Cassirer addressed perception in his 1944 essay:

In perception, too, we do not confine ourselves to the particular, given *hic et nunc*, to be completely absorbed and as it were, lost in it. We go beyond the particular and integrate it into a certain context. As the particular changes its position in the context, it changes its "aspect". We do not apprehend the particular as a mere "existence," that simple reality in which there corresponds a particular sensation to each particular stimulus. On the contrary, the apprehension of the particular *qua* "existence" involves apprehension of the possibilities of transformation which it contains within itself. The *perceived* phenomenal color differs from that "reduced" color- experience which corresponds to the retinal image. The former is conditioned and modified by "the perspective of illumination" in essentially the same way in which our visual perception of space is conditioned by the spatial perspective. (Cassirer, 1944:15).

The same approach of functional thought can be seen in the Gestaltists's views on perception when they stressed the importance of constructive form over the figure as represented in the retinal image. The logical account of perception considers that perception is not a reproduction but a process of construction that finds its expression in the application of forms. The Gestaltists applied functional-relational thought to their studies of colour perception. For example, if we have a grey piece of cloth, it does not mean that the colour of that piece of cloth will be always represented in experience with the same degree of greyness. We can perceive the colour of that piece of cloth differently depending on the illumination conditions. For example, if we put that grey piece of cloth against a black sheet of paper, we no longer perceive that grey piece of cloth as grey, but as light and bright. In contrast, if we hold that grey piece of cloth against a white sheet of paper, then we shall perceive it as dark (Tye, 2000: 155).

Therefore the Gestalt psychologists argued against the constancy hypothesis because it ignores the fact that the phenomenological image of a particular colour is a place of transformations in respect to changes of illumination conditions.

If the Gestaltists' claim about the process of construction in perception had proved its applicability to perceptual space, motion and shape, how could the Gestaltists explain

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colour perception? I will try to answer that question by giving an example that discusses crucial constructive concepts that have been applied in colour perception.

Kohler sought to study colour constancy when he discussed the relationship between figure and ground. He designed an experiment involving a cross composed of alternate blue and yellow sectors. Kohler set the cross on the left side of a stereoscope and on the right he placed a regular blue octagon with homogeneous surface. The cross will be perceived either as yellow or blue depending on the background: the cross will be represented as blue if the background is yellow and yellow if the background is blue. This means that a certain transformation takes place in the phenomenological image representing the colour of cross.

The colour of object is determined by a factor that remains invariant in respect to the phenomenological image representing the colour of object. For the Gestaltists, concept of invariance is important for understanding the world of colour perception because it confirms that the colour of an object as represented by the phenomenological image has a relative colour property. Gelb admits this when discussing the concept of colour constancy saying:

Color constancy is but a part of a much more complex set of problems; we are confronted with the general problem of the organization and structure of the visible world (Cassirer, 1944: 10-11).

Let us now discuss structuralism as studied by one of the Gestalt scientists David Katz and his experiments related to colour perception.

7-6 Gestalt and Structuralism of Colour Perceptual Experience

The Gestaltists's distinction between retinal and phenomenological images can also be found in their distinction between “surface colour” and “film colour” when they studied colour constancy. Surface colour refers to the qualities and characteristics remaining during changes of illumination such as the yellowness of a banana. Meanwhile film colour refers to the characteristics of colour that are changeable in respect to changes of illumination. They paid more attention to film colour because it shows how the colour can be represented differently in the phenomenological image. The reason for the

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Gestaltists to defend film colour was to show the falsity of the constancy hypothesis (Hartmann, 1953: 22).

The Gestalt psychologists affirm that the nature of colour represented by phenomenological image underlies its relative constancy when the conditions of illumination are unchanged.

Cassirer applied his understanding of group theory, as a structural notion, to analyse colour perception. Cassirer argued that the same sort of transformations found in visual perceptual space can be found in colour perception. Each perceptual experience presupposes sort of transformations take place in perceptual experience under invariant. The experiments of Hering, Helmholtz and the Gestaltists showed the transformations in colour experience under certain condition of light intensity that would be invariant during the perceptual experience of colour.

In Hering's well-known experiment we experience the "shift" that occurs when a part of the field, being objectively darker than its environment, first appears as a spot and then as a shadow following [Sic] on the surface, and thus gives, while it is exposed to the same illumination as the white surrounding, first the impression of grey and then the impression of shadowy white. Here again the typical possibility of double orientation or reference is apparent.... [It] rests on the very same factor which is most explicit and striking in the formation of geometrical concepts. The perceptual image as well involves that reference to certain possible groups of transformation. It changes when we refer it to a different group and determine the "invariants" of perception accordingly. We may mention all those facts that are by Gestalt- Psychology described in terms of the category of "figure and ground". All these phenomena are remarkably analogous to the above-mentioned different possibilities of "coordination" in Euclidean, affinitive, projective, etc., geometries. Thus Katz, in referring to certain observation may shift from one mode of "apprehension" to another by distributing light and shadow in a different way. At one time, we see shadows falling upon a light ground, at another time we see light falling upon a dark ground; and we are free to choose either mode of apprehending.

(Cassirer, 1944:15-16).

To that extent, Cassirer's aim was to show the perceptual image of the colour possibly varies under the changes of illumination conditions. Colour perception is similar to size, shape and space perception in that they all imply possible transformations. They imply different perceptual structures that determine which perceptual form, among the other possible forms, will be dominant and will be apparent. The Gestaltists point to the phenomenological image when they talk about the apparent colour. They also refer to

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the transformations take place in colour perceptual experience where the phenomenological image presupposes such kind of transformations.

The concept of colour transformation leads us to discuss the concept of colour invariance and how the Gestaltists applied it in developing their structuralism of perception.

In the field of visual perception, it is not difficult to demonstrate the fact that there is a general tendency for the phenomena to tend to remain the same under changing conditions of observation. One must refer to a tendency and not to an absolute constancy since measurements reveal the fact that, as conditions of observation change, phenomenal characters do change although to a much lesser extent than one would expect if they were wholly determined by these changing observational conditions. (Thouless, 1951: 240).

The relative properties represent the main feature of the Gestalt's view on colour perception. The phenomenological image of colour will be determined through the conditions involved in perceptual situation. The characteristics of colour depend on the relative properties that appear depending upon a new factor that remains invariant (Koffka, 1935: 218-219).

Hering supports the idea that colour is changeable and transformable in the context of light changes. Cassirer tried to analyse colour perception as a theme that can be grasped under the meaning of group. A group theory, as considered a structural notion, is used here to explain the structuralism of colour perception. Let us now consider another aspect of the application of group theory on the theory of perception. As we have already seen, the major task of any theory of experience is to explain how we can get from the particular to the general; i.e. from a specific item, restricted by its *hic et nunc* and its irreducible singularity, to a general conception. The same problem appears in geometry. How can geometrical concepts be derived from the intuition of spatial figures? Or how can we, as Cassirer puts it, fulfil the passage "from purely local determinations to strictly spatial determinations.

Every particular triangle, every particular circle is to be considered as something in and by itself. Its location in space, the lengths of the sides of the triangle or the radii, etc., belong to its "nature", which latter cannot be defined except with reference to particular local circumstances. Even in our geometrical concepts, this reference is not simply ignored; it is not abstracted from such as to simply disappear. But here the local determinations are comprehended in such way that a new whole, "the system of space," results from their synthesis. The concept of group of transformations is, perhaps,

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the clearest expression of the nature and epistemological root of this systematization. Owing to this concept the particular, intuitively given figure is derived of its *hic et nunc* and nevertheless retains in definiteness. This definiteness no longer depends upon what the figure is as a “this” or “that”, as particular. The definiteness of the figure depends upon the context into which it is integrated and which it represents as a special case. (Cassirer, 1944:8).

What has this to do with colour perception? As we noticed above: during the perceptual process, we are constantly confronted with different aspects of a phenomenon that are physically bound to their *hic et nunc*. During our perceptual experience, these aspects are related to each other, they are synthesized such as to constitute aspects of one and the same thing. But what is this synthesis? It is nothing but a group-like transformation. Cassirer showed that the Gestaltists’s experiments of colour perception emphasize the fact that we go beyond the particular and its independent properties and integrate it into a certain context. When the particular coloured object changes its position in the context, it changes also its aspect. Cassirer clicked that issue by stressing the idea that the apprehension of the particular involves apprehension of the possibilities of transformation which it contains. Cassirer distinguished between the images provided by retina where there is no chance for colour transformations, and those apprehended by our reason as phenomenological image where there are possibilities of colour transformation.

He claims that formal, mathematical structures fundamentally characterize the way in which the perceptual system constitutes contents of visual experience; they are, as it were, naturally realized in the perceptual processes of determination. Cassirer showed, depending on Hering’s experiments, how apparent colour as represented on phenomenological image could vary in respect to illumination changes.

According to Cassirer there is an analogy between colour perception and the abstract concept of group. He argued that the processes involved in both are similar. The apparent difference between mathematical constructions and perceptual constructions will vanish if we take into consideration the concept of transformation as applied by the Gestalt psychologists as indicated above. Cassirer used an experiment by Gelb to explain the relationship between form and background when there is a colour contrast between them. Cassirer saw that there is always the possibility to perceive a form as a figure with certain colour as it appears to the perceiver and afterwards, another figure will be perceived with another different colour. The experiment of the blue and the

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yellow cross supports Cassirer's claim regarding the double orientation of colour perception. Here Cassirer concludes that there is a possibility of double orientation which transforms apparent colour to another different colour. Koffka agrees with Cassirer regarding the perceptual transformation and the double references where two new phenomenological images will appear differently. Koffka uses his own term "*Double Representation*" to express the same understanding where there is always the possibility of perceiving different phenomenological images when we change the conditions of perceptual situation (Koffka.1935: 178-179).

Both Cassirer and the Gestaltists were in agreement that colour perception, as mathematics concepts, implies a certain invariance and depends upon it for its inner constitution.

There is an experiment was designed by Katz to show that the colour on a phenomenological image is constructed in respect of factors set up in the perceptual situation. He supposed that a light grey piece of paper would be represented in a dark corner of the room. In addition, there is a colour wheel with black and white sectors near a window. The observer had to find a black-white mixture on the colour wheel that looked like the same grey as the piece of paper in the dark corner of the room. Katz claimed that under these conditions, a complete equality between the colour wheel and the piece of paper is impossible. Therefore Katz designed a screen with two holes introduced between the observer and the two matched greys. It follows that one hole is filled by light coming from the piece of paper, the other by light coming from the disk. The changes that take place in colour perception are that the colour wheel seems to be much lighter than the grey paper. However, if someone changes the mixture on the wheel so that the two holes look equal, and then removes the screen, the colour wheel will be almost black and much darker than the grey paper (Koffka, 1935: 248-251).

From these examples, it is shown that the Gestalt psychologists supported the theme of colour transformation and the relative properties of colour represented by the phenomenological image. The apparent colour as represented by phenomenological images is outstandingly analogous to the possible transformations taking place in geometries. Katz, Koffka and Hering emphasized the fact that under the same objective conditions, colour perception may shift from one mode of apprehension to another by

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disturbing light in different ways. This kind of understanding brings both Cassirer and the Gestaltists under the general perspective of structuralism. There is similarity between Cassirer's view and the Gestaltists's view on structuralism of perception. For example, Cassirer uses "*Given*" or *hic et nunc* and the Gestaltists agreed to use another term equal to "given" that is "*retinal image*". Both of these terms refer to the dogma that sensory impressions are the only valid candidates for representing external objects. The second parallel between Cassirer's term "*identity of object*" and the Gestaltists' "*constancy hypothesis*".

These two terms share the same meaning as an objection to the view that any particular external object is not necessarily given to us as a reproduction. The Gestaltists applied that structural view not only to perception but also to learning. They have a holistic and a consistent view to apply. There is a peculiar link between perception and learning, thus I would like to discuss that relationship and how it reflects their structuralism.

Gestalt and the Constructive Unity of Mind

8-1 Introduction

The aim of this chapter is to explain the structural aspect of the Gestalt theory of learning as an extension of their application of perception. My argument in this chapter will be devoted to showing the consistency and the systematic nature of the Gestalt view by discussing two issues that are related to perception: the problem of learning and objectivity of perception. The Gestaltists used the same functional-relational approach to study these two issues and this led them to a coherent and holistic view that is applicable to different problems of psychology. This consistency derives from a systematic and constructive unity of mind. That is why I found it is necessary to bring Cassirer in to the discussion in order to examine the mutual influence of the Gestalt theorists on him and Cassirer's influence on their latest views. Therefore, we shall argue that the influence of Cassirer is not restricted to their application of Cassirer's Functional-Relational thought to perception. Rather I found that Cassirer's influence on the Gestaltists extended to include their views on social life. The Gestaltists hoped to close the gap between nature and life by finding comprehensive forms to unify these two different areas. We therefore conclude that the Gestaltists pre-supposed the constructive unity of the mind by setting up a theory of personality to reflect that constructive unity.

8- 2 Gestalt and the Structural Theory of Learning

The Gestalt theory of learning is an extension of their view of perception where an objection is made to associationism, behaviourism, and structuralism in its traditional view. This traditional structuralism was discussed by Edward Bradford Titchener (1867-1927) who claimed that structuralism means that wholes are compounds of elements.

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According to Titchener, structure is the total sum of separated elements that are combined together to give that structure or form. Therefore the task of psychology is to discover the elements and the manner in which they are compounded. One must begin with the atoms or elements; science goes from the part to the whole. However, as we can see in their answers to the various problems of perception, the Gestaltists's account was opposed to Titchener's structuralism. The Gestalt approach to learning differs radically from the earlier views of associationism, behaviourism and contrasts sharply with most other modern views of learning that concentrate on such questions as how a conditioned stimulus gets attached to an unconditioned stimulus so as to elicit a conditioned response. The psychologists that support that claim usually vary in the terms they use to express the idea of conditioned stimulus; they sometimes use association, habits, and tendencies to describe the relation between stimuli and responses. Psychologists such as Hermann Ebbinghaus (1850-1909) and Ivan Petrovich Pavlov (1849-1936) defend that view and called it "learning by experience". The Gestalt psychologists consider learning as an application of their view of perception because the main theme of perception is carried on in learning. Learning involves a structural element that is not presented by experience. Thus the Gestalt theory of learning raises structural themes that are not presupposed by associationism and behaviourism. For example, the base understanding of the hypothesis of constancy that we viewed in perception, maintains its function in learning and can be understood via "trial- and error hypothesis". That hypothesis refers to learning as a process that takes place only through experience and through correspondence between the stimulus and the learner's responses to the stimulus. This view of the nature of the learning process has been grasped and maintained by Edward Thorndike (1874-1949) and Clark L Hull (1884-1952).

The Gestalt psychologists sought to present an account that contradicts these theories of the behaviourists. It seems to me that the starting point for the Gestaltist's view of learning is based on two steps. The first one was to reject the assumption that a learning situation depends on the mere association between elements and the repetition of that association by experience through trial and error. The second step was to maintain the holistic and structural view by applying it to a learning situation. In other words, learning is not about the composition of elements but is a creative process based on

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reproducing the patterns and the structures in a learning situation (Hilgard & Bower, 1966: 233).

The Gestalt psychologists thought that the whole that we experience in learning is a constructed whole in our mind and they denied that the whole is given out of the sum of elementary sensory experiences, as claimed by Titchener. They applied the laws of perception to learning. Their aim in applying these laws was to present a comprehensive way to explain the dynamic activities involved in learning situations. The Gestaltists criticised the behaviourist laws of learning. These laws are; the law of frequency, the law of effect, the law of exercise and the law of belongingness. The law of effect states that there are reinforcers such as food that strengthen stimulus-response connections or associations, and punishments such as shock that weaken them. The law of "exercise and frequency" imply that the repeated practice of a stimulus-response association strengthens it. Finally, the law of belongingness states that some things are easier to associate than others because they belong together. (Anderson, 1995: Also, Schwartz & Reisberg, 1991:111-13).

All these laws confirm the belief that all behaviour could be accounted for in terms of such stimulus-response bonds. Thorndike, as a representative of behaviourism, indicates that learning is understood as the direct association of stimulus and response without postulating any intervening mental processes. On the contrary, the Gestalt psychologists indicate that the learning can be developed not through the principle of association and what behaviourists call "Trial and Error", but only from the total situation of learning and through the pattern or the whole structure that appears to the individual and leads him to solve the problem. Learning is one aspect of the general view of perception. Their theories of both learning and perception apply the same idea of structure and field organization. This understanding can be seen through the Gestaltists's leading idea of insight as applied in learning. According to the Gestaltists, insight means meaningful behaviour and experience in the presence of any life situation. It is the suddenness of perceptual reconstruction of the field. When they use the term "insight" in learning, they mean the process of establishing a newly organized whole. The importance of the concept of insight in learning is showing that the learner, who faces a problem in a particular situation, can solve it if he re-perceives the whole situation in a new way, a way that includes comprehending logical relationships between the parts of the

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situation. This is the real essence of the Gestalt learning theory. Let us discuss two examples due to Wertheimer and Kohler.

The first example shows that learning is not just a matter of adding new isolated elements to each other, but also requires the ability to re-arrange and group parts in a systematic whole. In other words, it involves a change from one Gestalt or structure to another Gestalt. In 1943, Wertheimer published his remarkable book *Productive Thinking* which was concerned with insightful learning in school children. He emphasized the apparent role of structure in problem- solving. He argued that the ultimate goal of learning lies in the ability to find new, creative solutions to problems that we face throughout the learning processes. For Wertheimer, these solutions cannot come from training the child to give the right responses to the right stimuli. On the contrary, they lie in understanding the problem or the situation not as separated elements but as an integrated whole. For example, Wertheimer was attending a school mathematics lesson, where the pupils learned how to find the area of the parallelogram which is equal to the product of the base divided by the altitude. The pupils learned the method of finding the area of a parallelogram by dropping one perpendicular from the upper left corner and another perpendicular from the upper right corner. Then we extend the base line to the right, we call the two points *e* and *f* as is shown in figure (8-1)

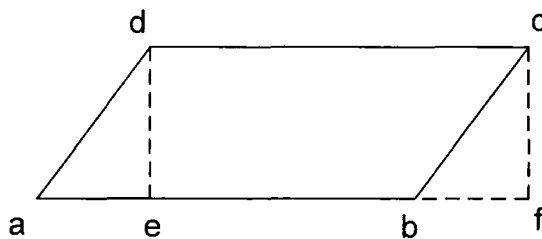


Fig (8-1)

Wertheimer wanted to make sure that the pupils learned how to find the area of parallelogram not in a slavish way, through blind repetition: he sometimes uses this phrase to refer to the pupils when they apply what a teacher says word for word without discovering new ways of solving a slightly difficult problem. It is the creativity of learning or what Wertheimer calls the “productive thinking of learning” (Wertheimer, 1961: 60-63). Therefore Wertheimer went to the board and drew this figure as it is shown in figure (8-2)

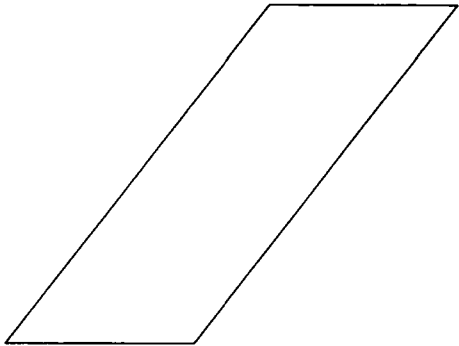


Figure (8-2)

Although Wertheimer drew the same parallelogram, he found different responses from the pupils to the figure on the board. One of the pupils raised his hand: “Teacher, we haven’t had that yet”. (Wertheimer,1961: 60). Other pupils copied the figure on paper, they drew the auxiliary lines as they were taught, dropping perpendiculars from the two upper corners and extending the base line, as it is shown in figures (8-3). After the pupils drew the figures that were vague in identifying what they learned, Wertheimer told them, there was still a chance to represent the figure as they had learned it. Most of pupils were surprised but a few of them smiled and started to work out the problem. Some of the pupils mastered the problem by drawing the following lines in figure (8-4A) or by turning their papers 45 degree, and doing as it is shown in the figure (8-4B)

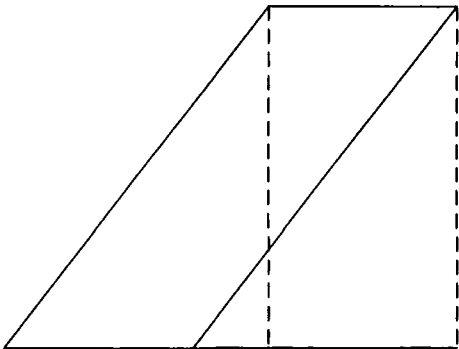


Figure (8-3)

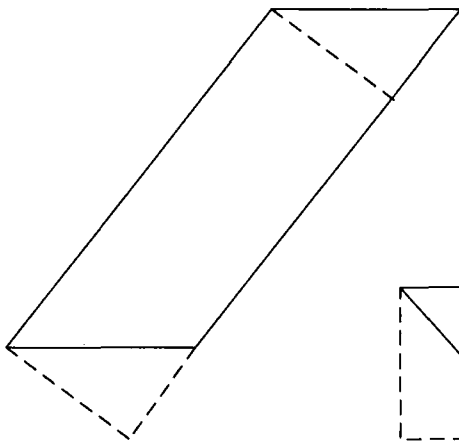


Figure (8-4A)

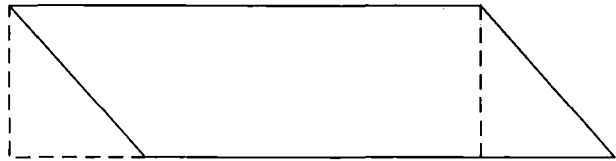


Figure (8-4B)

For Wertheimer, the pupils who successfully mastered the problem were those who could re-arrange the relations between parts and re-organize and re-group them again within a new structure. The pupils who mastered the method of finding the area of the parallelogram confirmed the idea of the structural element implied in the learning situation. The success of solving the problem of finding the area of parallelogram meets our criterion of defining structuralism as a pure possibility of re-arranging the elements within new wholes:

If the pupils have really grasped the issue, then for them three lines are not just “this line, and that line and the other line” or, as the teacher said, “a vertical line drawn from the upper left corner, another from the upper right corner, and a prolongation of the horizontal line from the lower right corner”. They are not an and- sum of items, blindly connected with the solution.... But if they have grasped the problem then they see the lines in their *structural role and function*, in their meaning within the sensible context. They see how these lines, just these in this situation, bring about the solution in the inner *relatedness*, the structural relation of these operations to reaching the goal. The operations are viewed “from above” from the vantage point of the inner structure of the whole procedure, as they function within the context and fit its requirements. (Wertheimer, 1961: 65).

Wertheimer applied that structural understanding to other problems in learning, such as the problem of the vertical angles: if we have two straight lines intersecting from two angles, A and B, how can you prove that they are equal? He explained that to solve that particular problem, we need to understand the structural aspect of the mind. The mind is not ruled by habits to which it sticks blindly by repeating what it has learned. Instead, the mind is ruled by systematic rules that help us to re-arrange the elements of a

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situation in a new form. This is what the Gestaltists call creative learning. This is a kind of transformation that could not result from mere association but arises from the mind and its dynamic activities to create new powers of organization.

I would like to discuss another figure of the Gestaltists who led the investigation a step further by applying the Gestalt structuralism to a new area of research: animal learning. Kohler's aim was to show that the ability of the mind even in the animal to create organizational wholes and finding the relationships between the parts of the learning situation.

Wertheimer gave all his attention to school children to show learning is presented as a part of solving a problem requires to give a creative thought to solve the problem, instead of just repeating what the pupil memorize. Other Gestalt psychologists applied solving-problem approach to animals including birds, hens, and bees. The Gestaltists indicated that learning is taking place when the individual thinks about the whole situation and the relationships between its parts and then gives a solution to the problem.

Kohler developed a number of experiments on space, size and colour perception then he observed the animals' behaviour in re-structuring the perceptual situation by arranging the elements implied in the situation and finding new relationships between them within the new structure. Kohler's famous book *The Mentality of Apes* (1921) is an attempt to show the constructive nature of thought in apes. Kohler rejects the behaviourists' attempts to explain animal learning as a process governed by trial and error. In contrast, he thought that animals could learn progressively only when they managed to find relevant relationships between irrelevant parts in a learning situation. When the animal could find these relevant relations and re - arrange the elements involved in the perceptual field, giving them a new order, the animal comes up with a new solution to the problem. Kohler presented these conclusions when he served as the director of the Prussian Academy of Science's station for the observation of apes at Tenerife in the Canary islands. Kohler argued that apes could achieve a good standard of learning by finding relationships between unattached elements in a perceptual situation. To prove that assumption, he designed different experiments that proceeded systematically from simple to more difficult

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tasks. Kohler chose an active ape called Sultan. To pass the test successfully, Sultan needed to re-arrange the irrelevant elements by finding relationships between them and use them to solve the problem. This understanding can be summarized by Kohler's primary question of whether chimpanzees showed insight in their behaviour. To prove that presupposition, Kohler designed some tests to see how the problem of learning is related to the general problem of perception and reflects the systematic unity of the mind Kohler answers the above question. .

In this test, two bamboo sticks were provided, each too short to reach the fruit. But one stick could be fitted into the other, and thus when put together the tool would be of adequate length. In another experiment the animal sat close to the bars of its cage, opposite the goal which was outside the cage. In the animal's hands was a stick, which, was too short to reach the goal. Outside the bars, some two meters to one side of the goal, but lying nearer the bars, was placed a longer stick which could not be reached with the hand, but could be reached with the aid of a box placed under it (Koffka, 1928:204-205).

These experiments showed that learning takes place when one thinks about the whole situation and arranges its parts within new structure. The new structure of arrangement involves a set of relationships between the parts. Finding a convenient relationship between the parts, as fitted within a structure, leads to solve the problem. Kohler in his 1927 and Koffka in his 1928 presupposed that the separate elements in the perceptual field acquired new functions within the new structure.

In all these experiments, the animal reaches a creative solution to the problem. For example, imagine the elements of the situation are re-arranged and the animal discovered the possible relations between them, in that case, the animal will be able to consider different solutions and select the appropriate one that will enable it to overcome the problem. Of course the animal can not re-arrange the elements of its perceptual field and master the problem unless it could set up a structure within which these elements can be fitted. This means that the structure is logically prior to the elements that compose it. The realization of "relations" is very important because it leads to a significant transformation in perception and then learning. For example, when

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the stick is presented in the perceptual situation, it was a separate element in the perceptual situation. There was no particular relationship between it and the fruit. But when the animal re-arranged the perceptual situation and the embedded elements, it could find a relationship between the stick and the fruit. The isolated elements embedded in the first perceptual situation could acquire a new functional value within the new perceptual structure. When the animal succeeds in fitting the isolated element within a new structure, then we can say a transformation takes place in its perceptual field.

The act of employing a stick seems to involve a transformation in the situation confronting the animal; for the stick, which at first was an object of indifference to the animal, now becomes definitely related to the situation. What the animal has actually learned is to make an irrelevant object relevant to the situation, which is something quite different from an external connection between certain sticks in the field of perception. (Koffka, 1928: 210).

Both learning and perception imply the same structural aspect where there is always the possibility of transformation in the perceptual field. Both involve the possibility of re-arranging the elements within holistic forms. Every element of that structure acquires a new relational meaning in respect of its relationships to other elements within the same structure. The link between perception and learning is the idea of relation and functional role. The awareness of relationships is not ascribed just to mankind: animals also seem to have this faculty of understanding relations and can apply them to different complicated situations. Cassirer agrees with the Gestaltists that what their experiments show the function of the mind is to *construct* objects not to receive them as *given*. I would like here to discuss the constructive unity of mind as conceived by Cassirer and the Gestaltists.

8-3 Gestalt and the Constructive Unity of Mind

To show the constructive nature of mind, we need to presuppose that there is a monism implied in the Gestalt view. This monism reflects the comprehensive view of the Gestalt as to be applied to different aspects of physical and social realms. The Gestalt is a view of realizing the form that precedes its parts. I ascribe to Gestalt an idea of holistic

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monism. This “holistic monism” presupposes that the whole precedes the parts, and that in every aspect of knowledge, the mind constructs its objects by stressing the whole over its constituents. It is a systematic view that organizes the relationships between the whole and the parts. Here we are going to claim that the Gestalt holistic monism can be traced to different realms of science and civilization. Once we prove the need for these comprehensive and holistic structures required for experience, we shall show that there was a primary presupposition made by the Gestaltists that formed their understanding and analysis of experience. This primary presupposition is that there is a systematic and a constructive unity of the mind that brings consistency and coherence to our understanding of experience and its different aspects as viewed from different areas of sciences and in the perception of daily life. Therefore, I claim that the constructive unity of the mind can be traced in three kinds of unity as follows:

- 1- The unity of the senses.
- 2- The unity of science.
- 3- The unity of the realms of civilization.

All three kinds of unity are aspects of the general theory of personality. These three aspects form a comprehensive perspective for a person. Through them a person can see the whole through the parts and the constant through changes. According to the Gestaltist’s view, a person will achieve his personality when he is able to adjust himself to new experiences and new social situations that require him to create holistic structures to fit his behaviour and action within these structures. Let us briefly discuss the claim regarding these three kinds of unity. I will discuss the first two kinds of unity and I will delay the last one to bring it together in a context with Cassirer’s view of the nature of mind.

8.3.1 The Unity of the Senses

The unity of the senses is one category that, we hope clearly reflects our claim of the coherent unity of the mind. Therefore I will depend on 1927 a paper titled “*The Unity of The Senses*” by Gestalt psychologist Erich M. V. Hornböstel which argues that there is unity between the different senses. Although every sense has a different function, at

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the same time there are some phenomena that need two or three senses to work together in order to be understood. He firstly uses a linguistic and a historical perspective to present his view. He argued that in the French language for example, the verb “sentir” does not refer to one sense but refers to smell, touch and feel all together. He also adds that in some African tribes, although they have one word for “seeing” they use one general word to refer to “hearing”, “touching”, “smelling”, “feeling” and “tasting”. (Hornbostel, 1950: 210-211 From Ellis, 1950).

Hornbostel indicated that we depend on more than one particular sense to perceive the apparent movement of an object. But, the apparent movement can possibly be perceived through the eye, the ear, or the sense of touch. It does not depend on seeing or hearing alone. Rather, all senses work co-operatively to perceive the movement of an object.

What is essential in the sensuous- perceptible is not that which separates the senses from one another, but that which unites them; unites them among themselves; unites them with the entire (even with the non-sensuous) experience in ourselves; and with all the external world that there is to be experienced. (Hornbostel, 1950: 214).

It seems to me that Hornbostel’s claim is supported by the Gestaltists because the unity of the senses presupposes another unity: the unity of the mind that generates and creates those structures or non- physical elements that unify our experience. These structures are not extracted from experience but are generated by the dynamic activity of mind and its endless ability to produce a “creative process of synthesis”(Koffka, 1928:225-226). An example that shows that there are structural meanings involved in experience, occurs when we listen to someone, we do not listen to a stream of words disconnected but rather we obtain knowledge by structural meanings that bring all these spoken words within one context that allow understanding of the significance of what has been delivered. What we understand from the delivery is not the sum of the separate words but our understanding presupposes a context where these words will be fitted and grouped together to give a meaning. It is similar in the case of art. What is essential in a work of art does not lie in the sensuous- perceptible but in the meaning that we grasp when perceiving that work of art. It is the meaning that emerges from the continuous activity of the mind, and is a prior to sensual experience. To sum up, Hornbostel

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indicated that none of the senses makes a contribution to cognition independently of the others. This unity presupposes the unity of the mind:

It is the same organizing principle which calls forth organism from mere substance, and which binds the stream of happening into wholes, which makes the line a melody which can follow, and the melody a figure which we can see in one glance. Since the sensuous is perceptible only when it has form, the unity of the senses is given from the very beginning. (Hornbostel, 1950: 214).

8.3.2 The Unity of Science

The unity of science has been presupposed by the Gestaltists. They aim to verify sciences by claiming that natural sciences and the humanities; general psychology, social psychology, education and sociology can be viewed from the structural perspective since all these sciences involve the same creative process of construction. The Gestaltists worked under this theme that physical sciences and humanities share the same basis of understanding. They have the same constructive nature: the scientists and psychologists are investigating their objects by reducing them to the general rules of understanding. In respect of these rules, actions, events and behaviours are organized and behave accordingly. The starting point in exploring the constructive aspect of these sciences is to study them in the light of the concept of isomorphism as explained in Chapter Five. The unity of science presupposes two different processes; *crumbling or fragmentation* and *synthesis*. These two processes had been used, I claim, to postulate the idea of the constructive unity of mind. For example, when the Gestalt psychologists used the concept of isomorphism, they referred to the possibility of analysing some psychological problems depending on the facts of physics and physiology. I call this way of thought “*synthesis*” where they presuppose the unity between all these sciences. On the other hand, I find that Gestalt psychologists use another way of thinking to prove what they postulated earlier as “the constructive unity of mind”. They paid attention to particular sciences and sought to bring out the holistic laws that organize the processes of each science. Their interest in of particular sciences included different branches of psychology like social psychology, developmental psychology and therapy. In addition, they paid attention to sociology and education. They aimed to capture the structural characteristics implied in each science. I call this way of thinking “*crumbling or*

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fragmentation". This process of synthesis is an upward movement, while the process of fragmentation is a downward movement.

Let us examine these two approaches showing the constructive unity of mind. Max Wertheimer firstly pointed out that some physiological processes were involved when he was studying apparent movement what he calls phi-phenomenon. Although Wertheimer did not specify a certain principle this shows the similar processes between perception and physiology. He also indicated that these processes are unitary and holistic. It was Kohler who brought the similarity between physiology and psychology under the concept of isomorphism. He argued that isomorphism means that the forms of experience are not essentially different from the physical forms in the nervous system. In other words, in a given case the organization of experience and the underlying physiological facts have the same structure. The question now is although both organic and inorganic life are different in nature, why did the Gestaltists see the possibility of bringing the sciences that study these two different domains together? The answer lies in the constructive nature of the mind. Koffka argued that Wertheimer was right in his claims about isomorphism because he could gather the realms of physiology and psychology under one view:

What he said amounted to this: let us think of the physiological processes not as molecular, but as molar phenomena. If we do that, all the difficulties of the old theory disappear. For if they are molar, their molar properties will be the same as those of the conscious processes which they are supposed to underlie. And if that is so, our two realms, instead of being separated by an impassable gulf, are brought as closely together as possible with the consequence that we can use our observations of the behavioural environment and of behaviour as data for the concrete elaboration of physiological hypotheses. Then instead of having one kind of such process only, we must deal with as many as there are different physiological processes, the variety of the two classes must be the same. (Koffka,1935: 56).

The Gestaltists describe the behavioural environment as molar behaviour in respect to the physiological processes. Wertheimer showed that molar behaviour will be a field process where we can study behaviour in respect to the field in which it takes place. They determine the task of their psychology as: *the study of behaviour in its causal connection with the psycho-physical field*. (Koffka,1935: 57). The Gestaltists sought to study the behaviour as an event in that psychophysical field and the forces exist within it.

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In order to show the constructive unity of the mind as applied to science, we consider this formula “the whole phenomena are more than the sum of their parts” to be the most general rule of the mind. The Gestaltists applied it as a universal and a systematic rule that has to be implied in every science and which brings the relationship between the contents and the laws of each science.

To prove that every science applies that formula, they apply now what I call *crumbling or fragmentation*. By fragmentation, the Gestaltists dealt with each science separately, trying to show its systematic nature and the way it constructs its objects. Therefore they showed that every science involves a holistic way of construction that is presupposed in all sciences. By applying that, the Gestaltists do not aim to combine sciences but to analyze the general themes of each science and find out what is common between them. I am going to show how they apply it to prove the systematic unity of mind. They argue that there is a process called “self-structuring” implied in the sciences. The scientists do not investigate the facts of science in respect to stimulus- response formula, rather they respond to the pattern of stimulation response in the organizational field. The Gestaltists explained that by stating that the operations of the nervous system are not restricted to primitive local processes but respond to a situation, first by dynamic sensory events that are peculiar to it as a system (Kohler, 1947: 165). Every science is a product of the whole organizational field. For example, in chemistry, the chemist understands any chemical product not only as a sum of chemical elements but also as a product of organizational relations between chemical elements. Kohler gives the following example to show that chemistry reacts to the whole organizational field:

Suppose that somewhere in a factory HNO_3 were produced out of its elements, and that in another part of the factory the acid were used to dissolve silver- would it be right to say that silver reacts to nitrogen, hydrogen and oxygen? Surely, such a statement would be utterly wrong, because what happens to the silver depends upon the chemical organization of the acid, and cannot be understood as a reaction to those elements or to their sum. (Kohler, 1947: 165-166).

The same understanding also applies to H_2O or any other chemical compound. We are here descending from chemical thought to chemical substances and in that process we are witnessing the holistic and systematic nature that is involved in chemistry that gives priority to organization and order over the particulars. This process is what I call

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fragmentation; it is the downward movement that begins from the whole toward its parts. Every science finds the relationships between its elements in regard to its general laws. It is a downward movement where the mind moves from the whole to particular and forms its contents. The same process is also involved in psychology where behaviour is not a response to local and separate stimulus but rather a response to the total pattern of the environmental field. Kurt Lewin also applied that method of analysis to social psychology and interpreted human behaviour in the light of the social forces involved in the social situation.

These two methods of synthesis and fragmentation are two methods that reflect the ways of organizing the relationship between the rule and the content. In each process the mind brings unity and a systematic view to the discipline and either the mind reflects the internal unity involved in each science or tries to bring two different disciplines together depending on the presupposition that each of them involve the same structural rules and there is possibility to bring them in more general unity that is the systematic unity of the mind itself.

8.3.3 The Unity of the Realms of Civilization

It is the third kind of unity that shows that the holistic systematic nature of the mind is applicable to different aspects of life and its problems. Therefore, I will delay this discussion to bring Cassirer into that context. It seems to me that there is also another similarity between Cassirer and the Gestaltists regarding the claim of the constructive and systematic unity of mind. However, I argue that although both applied the same structuralism, the goal behind that application differed in each version of structuralism as we explain at the end of this chapter.

8.4 Cassirer and the Gestalt View of the Constructive Unity of Mind

In this section I will discuss the constructive unity of mind in the light of the general perspective of Cassirer's view of symbolic forms that implies structural meanings that

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combine between the different forms of civilization. We could see, through the argument that I set up and developed in this chapter and the other chapters, both Cassirer and the Gestalt psychologists chose the structural model to interpret the objects of thought and both interpretations emerged from Kantian transcendental philosophy. Both believed in the dynamic activities of the mind for arranging and ordering experience. Cassirer and the Gestaltists indicated the creative synthesis of the mind and its ability to create structures that give the particular its characteristic. For instance, the Gestaltists were influenced by the German philosophical heritage which reflected in their analysis of human behaviour and the themes they discussed such as Gestalt, pragnanz and organization. . They conducted some experiments, explaining their results by these laws, and showing the constructive role of the mind in organizing and transforming the raw facts of experience.

Cassirer also understood the new Kantian spirit as it emerged from The Marburg School and in particular Cohen. This comprehension led Cassirer to apply that new spirit to different realms of science and reality. In fact, both Cassirer and the Gestaltists strongly supported the constructive nature of the mind and its supreme capacity to provide us with systems that arrange our experience. Being a philosopher, Cassirer had profound knowledge that allowed him to apply his Functional-Relational view to different aspects of reality including science, art, music, culture, myth and religion. I claim that Cassirer, when he published his *Philosophy of Symbolic Forms*, wanted to extend his invariance theory of experience to become a general invariance theory of civilization. It was interesting to find not only that the Gestaltists shared with Cassirer the application of the Functional-Relational view to perception, but they too applied it to different areas of life and reality. For example, Wertheimer wrote essays on Truth, Democracy, Freedom and Ethics, applying Functional-Relational thought to these concepts. For example, he understood the concept of democracy not by comparing the different forms of democratic governments and their constitutional laws, but rather by studying the inner structure of it and the function it performs in the social field and its impact on individual behaviour:

- Stating and discussing items in subtractive abstraction is not enough. We have to consider their structural function. The methodological approach is not only to compare different forms of government by comparing items taken in subtractive abstraction, but to study the I as a part in inner

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structure of the object and to view the system structurally in its functioning a part in its field. (Wertheimer,1937, Quoted from Henle,1961: 51).

The agreement between Cassirer and the Gestaltists reflects their belief in the systematic nature of the mind and its orders to bring unity to the chaos of experience. The Gestaltists held that thought and applied it to different aspects of reality by referring to Cassirer himself. We can see in (1961) Wertheimer refers to the importance of using Functional-Relational thought when discussing the concept of velocity as discovered by Galileo, the same problem that Cassirer discussed before him in his *Function and Substance* (1910). Lewin refers to Cassirer in his (1935) when he distinguishes between Aristotelian and Galileian modes of thought in contemporary psychology, in addition, Lewin himself says in different places that his field theory is associated with Cassirer (Smith,1997: 687). The Gestaltists' references to Cassirer do not refer to a mere accidental impact but show his deep influence.

Lewin referred to the constructive process of understanding several times. The idea of a constructive method was clearly mentioned by Lewin in his article titled "*Field Theory and Learning*" (1942). Lewin used the phrase "constructive method" to refer to the nature of the processes in both exact sciences and social sciences. He agreed with Cassirer that thought is a genetic process not generic where the former refers to the ways understanding constructs the objects and arranges the constituents of the whole under structural forms, while generic process refers to the a process where the whole is composed by a reference to its parts as independent identities.

The essence of the constructive method is the representation of an individual case with the help of a few "elements" of construction. In psychology, one can use psychological "position", psychological "forces" and similar concepts as elements. The general laws of psychology are statements of the empirical relations between these constructive elements or certain properties of them. It is possible to construct an infinite number of constellations in line with those laws; each of those constellations corresponds to an individual case at a given time. In this way, the gap between generalities and specificities, between laws and individual differences, can be bridged. (Lewin, 1942: 212-213).

Lewin applies that understanding of the constructive method to his own concept of life space. The concern now is not focused on the objects but on the structure that organizes the whole situation.

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The center of interest shifts from *objects to processes*, from states to changes of state. If the life space is a totality of possible events, then “things” that enter the situation, especially the person himself and psychological “objects” have to be characterized by their relationship to possible events. (Lewin, 1936: 16).

We can notice from Koffka’s examples regarding the transformation of figural form from two- dimensional and three- dimensional space depending on the changes that take place in the framework we adjusted. Like Cassirer, who stressed the idea of group and its application in geometry and physics, Kohler and Koffka stressed the idea of structure and organizational whole implied in perceptual space. The Gestaltists sought to show that the structural view involved in geometrical space is also involved in perceptual space and in social space as discussed by Lewin. It was not accidental that Lewin referred to Cassirer throughout his books such as; *A dynamic Theory of Personality* (1935), and *Resolving Social Conflicts* (1948) and his article *Constructs in Field Theory* (1944). In addition, there is his article *Cassirer’s Philosophy of Science and the Social Sciences* (1949), edited by Schilpp to discuss the validity of Cassirer’s constructivism to be applied to social sciences.

Lewin agreed with Cassirer that the aim of science is not to focus on the properties of a given as a thing with independent properties, but to construct the object of knowledge by structural processes. Objects of knowledge are not given but instead created. Cassirer calls the principle that organizes this kind of activity a genetic principle, rather than a generic principle. Lewin used the term “genetic principle” to point to the dynamic principle responsible for organizing the components involved in the social situation. In addition, Lewin used Cassirer’s term “genetic principle” to point out the method of construction implied in social psychology.

It has been shown, in opposition to the traditional logical doctrine, that the course of the mathematical construction of the concepts is defined by the procedures of the construction of series. We have not been concerned with separating out the common element from a plurality of similar impressions but with establishing a principle by which their diversity should appear. The unity of the concept has not been found in a fixed group of properties, but in the rule, which represents the mere diversity as a sequence of elements according to law. (Cassirer, 1923: 68 Quoted from Lewin, 1949: 277).

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Lewin explained the meaning of structural properties by referring to Cassirer again. He stated that:

In the social as in the physical field the structural properties of a dynamic whole are different from the structural properties of their subparts.... Structural properties are characterized by *relations* between parts rather than by the parts or elements themselves. Cassirer emphasizes that, throughout the history of mathematics and physics, from the present day, problems of constancy of relations rather than of constancy of elements have gained importance and have gradually changed the picture of what is considered essential. (Lewin, 1949: 280-281).

Lewin applied the understanding that emerged from his awareness of the new developments in modern geometry to what he calls "life space". Lewin indicated that in life space there are different social groups that have various social relationships representing what he calls "social units". In social life, our aim is to find out the structural properties of the groups and its members that are to be considered as a whole situation, and to understand the dynamic process that organises the relationship between the individuals and the region in which social responses take place.

Groups are sociological wholes; the unity of these sociological wholes can be defined operationally in the same way as a unity of any other dynamic whole, namely, by the interdependence of its parts. (Lewin, 2000: 60).

This is analogous to a geometric space. "Life space" has the same constructive meaning as in geometrical space. For instance, Lewin claimed that any social response from an individual submits to social situation as a whole and the single aspects involved in the situation. According to Lewin, there is equivalence between geometrical space and life space:

If one tries to make an explanation in terms of dynamic relations, one comes to assumptions about the structure and the properties of the basic facts that seem to be equivalent, at least in their mathematical form, regardless of the terminology in which they are expressed. One must always go back to these invariant relations in the last analysis if one wants to derive the behaviour of a person conceptually. It seems to us therefore that the principal task of any dynamic psychology is to investigate and represent directly these relations. (Lewin, 1936:81).

Lewin also sought to show the constructive process involved in social situations. Lewin's aim was to bring the process of construction in science into his social psychology in modified form. For example, he replaced the concept of invariant with

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his new vision of a “region”. Every social situation involves a region that orders and arranges the social relations within it to meet the needs of the situation. When we enter a new social situation, we construct a new region within which the social relations can be organized. For example, consider a two-year-old child who does not want to stop playing and does not want to go and wash his hands. His mother knows that he likes to wet the wash cloth in the basin himself, so she asks him: Do you want to wet the cloth or should I do it myself? Because he wants to do the job, the child goes directly to wash his hands. Lewin explained the change in the child’s social behaviour by referring to the question that his mother asked which transformed the situation from playing to washing. The child begins to behave according to the requirements of the new situation and re-arranges his social response in a new region. This new region or social situation involved a form according to which the behaviour changes regarding to that new form.

For example, in the “playing” situation the child’s response to the social elements implied in the situation was consistently arranged in respect of the playing situation as a whole order. When the special situation is changed from playing to washing, the child changed his response according to the new region that represents a new holistic structure and requires different elements and new relations among them in certain order. According to Lewin, life space has its structure, which means nothing more than the relative positions of someone's response to the whole situation.

Lewin was convinced by the idea that any social situation presupposes a holistic structure that organizes the relations between the elements of the structure. Therefore, I claim that, under the influence of Cassirer, Lewin re-applied the concept of structure to the field of social psychology. He argued that the changes that may take place in life space include those changes that occur to the structural properties that exist between individuals themselves as parts of the situation or in the nature of the social situation itself to be considered as a holistic structure. These changes can be described as an increase in the differentiation of a region by increasing the number of sub-regions or alternatively by decreasing the number of sub-regions or combining separate regions into one region, or finally restructuring the whole order or changing the pattern without decreasing or increasing the parts implied in the situation.

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He discussed some examples to show the changes that take place either in the parts implied in the social structure or in the structure itself. He gave the example of marriage and how it varies according to the differences of culture, race and religion as an example of the changes in the sub-groups involved in the marriage as a whole social situation. On the other hand, he gave an example of democratic and autocratic groups and the patterns of learning that were acquired among the individuals who represent the members of these two groups, as an example of the changes took place in the social situations or social fields (Lewin, 2000: 364).

Lewin ascribed to the space region a relative nature because the individual's response is determined by the region.

Why the region in which a person stands is so important for his behaviour becomes intelligible when one realizes how great the change is which is brought about by a transition from one region into another, even within an otherwise unchanged life space. As a rule all relations of neighborhood are changed by such a transition: Regions which were before adjacent to the region of the person are no longer so and vice versa....In short, the dynamic condition of a person depends in almost every respect directly on his position in a certain region. (Lewin,1936: 99).

Generally speaking, the Gestalt psychologists focused on the characteristic of region that remains invariant under certain conditions.

I would like here to address two issues that the Gestaltists discussed which generally reflect common agreement between them and Cassirer.

The first problem on which it seems that they were in agreement concerns the relationship between the particular and the universal. How did they understand this relationship within perception?

Cassirer and the Gestaltists agreed on the relationship between particular and universal. They considered the universal as logically preceding the particular, and for the particular to be grasped, it needs to be understood in relation to universal rules. According to Functional-Relational thought, the particular has no meaning in itself, it is not a separate and independent entity. The particular becomes a member that has a relative place within a structure and its characteristics are determined by its relationships with the other elements involved in the structure. Thus the particular is

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characterized by the ability to change when the order and the arrangement of the system are changed:

Each universal relation, that it establishes, has a tendency to connect itself with other relations, and by this combination to become more and more useful in the mastery of the individual...The "participation" of the individual in the universal thus appears no more a riddle than the logical fact that, in general, various conditions can be united intellectually into a unitary result, in which each is fully retained. (Cassirer, 1923: 255-256).

The same understanding of the relationship between the universal and the particular is applied by the Gestalt theorists. The Gestaltists agreed that the particular acquires its meaning and function within the structure. For example, if we consider the Gestalt theorists' definitions of the *Gestalt*, we notice an agreement among them that the individual has no structural meaning apart from the function it performs within the structural whole. Wertheimer defines the Gestalt as the follows:

A Gestalt is a whole whose characteristics are determined, not by the characteristics of its individual elements, but by the internal nature of the whole.

Kohler (1933) defines the Gestalt: "*a separate whole*" with reference to the field concept. He states that: "Whenever a process becomes dynamically distributed and arranges itself in accordance with the constellation of determining circumstances in its entire field, that process belongs in the realm of Gestalt psychology."

Finally in his (1929) *Das Gestaltproblem*, Matthaiei; defines Gestalt as follows:

The whole and the parts mutually determine the structural coherence of a Gestalt. The parts are dependently related to the whole, but they affect its organization. (Katz, 1951: 92).

Perceptual experience and its elements always presuppose a kind of systematic structural order. These orders set up relationships between the parts where coherence and consistency between the parts exist as we found in visual experience of space. For example, Koffka, through his definition of the law of *Pragnanz*, shows these logical relations implied in that law. He states that:

Psychological organization will always be as "good" as the prevailing conditions allow. In this definition the term "good" is undefined. It embraces such properties as regularity, symmetry, simplicity" Koffka ascribed some other logical characteristics to the law of *Pragnanz*, in his *Gestalt*

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Psychology (1935) such as; unity, simplicity, harmony, inclusiveness, and conciseness. (Koffka, 1935, 110).

Cassirer and the Gestalt theorists indicated the need for these structural orders when we arrange the elements of experience. Cassirer expresses that idea as “*the invariant theory of experience*” and the Gestaltists reveal the same understanding in their expression “*the constitutional theory of experience*”. These two expressions refer to the same fact that the unity of experience reduces to a systematic unity of mind that ascribes orders to its elements. The attempt to arrange the chaos of experience and give its elements a systematic unity was the reason for both Cassirer and the Gestaltists to adopt a structuralist theory of perception.

The second agreement between Cassirer and the Gestaltists was the task to convert perception as a view of subjective judgement into a view of objective judgement. Cassirer accepted the Kantian transcendental concept of objectivity. He applied that understanding of objectivity to different concepts and perception. In *The Problem of Knowledge* (1950), he summarized it as follows:

The new critical transcendental concept of objectivity must be extended. This had nothing to do with the existence of “things in themselves” but solely with the order of appearances. A strictly lawful connection of phenomena is possible only, as the Critique had shown, when they are brought under definite rules. And these empirical rules presuppose the universal “principles of the understanding” which Kant called the “analogies of experience”. (Cassirer, 1950: 119).

Being a Neo-Kantian philosopher, Cassirer transcended the Kantian dualism between sensibility and understanding and re-establishes his view on the principles of understanding alone. The monism that we ascribed to the Marburg School came from that understanding as was illustrated in Chapter Two.

The question that seems to be critical to Cassirer, is whether objective perceptual judgements are possible. Cassirer maintains the critical transcendental concept of objectivity but reformulates it in the light of his invariant theory of experience. Therefore he agrees that objective perceptual judgements are possible in respect to the general views of invariant theory. In every perceptual experience, Cassirer distinguishes between two elements; the changing and constant elements of experience.

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He argues that knowledge must be set up on constant elements on which the judgement is formed. For Cassirer, there are two elements are involved in experience; one remains unchanged in the flux of experience, while the other is changeable and will dissolve and vanish.

We finally call objective those elements of experience, which persist through all change in the here and now, and on which rests the unchangeable character of experience; while we ascribe to the sphere of subjectivity all that belongs to this change itself, and that only expresses a determination of the particular, unique here and now. (Cassirer, 1923: 273).

This distinction between constant and changing elements led Cassirer to apply his understanding of group theory to present an answer of how perceptual judgements can be possible. He indicated that even if one distinguished the constant element from the changeable contents of perceptual experience, the constant element will not be always constant and hence unchangeable. On the contrary, he explained that the constant is a constant element in respect to a certain reference, but when the reference changes, the constant element will be replaced by another which would be a constant element for the new reference. Cassirer indicates there is no an element that will be absolute and unchangeable, but any element can be constant in perceptual experience in respect to a certain frame of reference that determines the perceptual experience.

The result of thus deriving the distinction between the subjective and the objective, is that it has merely relative significance. For there are no absolutely changeable elements of experience at any stage of knowledge we have reached, any more than there are absolutely constant elements. A content can only be known as changeable with reference to another, with which it is compared, and which at first claims permanent existence for itself. At the same time, the possibility always remains that this second content will be corrected by a third, and thus may no longer hold as a true and perfect expression of objectivity, but as a mere partial expression of being. (Cassirer, 1923: 273).

Cassirer argued that objectivity in that sense can be applied in both natural and human sciences on the basis of that understanding. Cassirer indicated that there are different degrees of objectivity in sciences. For example, in the case of perception, sensuous perception refers to a real objective knowledge as opposed to dreams and hallucinations. The same thought applied when we compare physics to perception. Physics is a science not about physical and immediate things or direct behaviour of physical objects, but it is

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about the abstract view of matter and physical forces not as we perceive them but as represented in an abstract formula.

Kohler argued that psychology can be seen as objective science if we replace the view that perception is about a direct or immediate experience with the view that it is about objective experience. Objective experience can be drawn from their distinction between the retinal image and the phenomenological image. The phenomenological image represents a constant element in respect to a reference on which we distinguish between what is subjective and what is objective involved in perceptual experience. The Gestaltists wanted to confirm the constant elements involved in perceptual experience, therefore the experiments of Katz, and Gelb on colour perception, Koffka and Kohler's experiments on perceptual space, Wertheimer's experiment on apparent movement, and learning and finally Lewin's experiment on social psychology all reflected their belief in perceptual experience as objective. The Gestaltists' experiments, discussed throughout this chapter and the last two chapters, were attempts to overthrow the view of perception as a mere mosaic aggregate of scattered sensations in favour of a critical theory of the objectivity of perception. The Gestaltists consider perception to be governed by a group of relative transformational characteristics and invariance.

To that extent, the Gestaltists shared Cassirer's invariant theory of experience and the experiments they designed reflect the importance of constant elements in perceptual experience. On the other hand, Cassirer depended on their experiments to provide evidence for his invariant theory of experience. In addition to the objectivity of perception, the Gestaltists went some way to answering Cassirer's call for a "psychology of thought". "Psychology of thought" refers to a transformation in the principles of psychology that constitutes a peculiar problem for epistemology. The psychology of thought presents a productive approach to investigation. Cassirer explains it as follows:

Psychology of thought does not study thought where thought merely receptively receives and reproduces the meaning of an already finished judgemental connection, but where it creates and constructs a meaningful system of propositions. When psychology pursues this line of enquiry and considers thought equally in the concrete totality of its productive functions, the initial opposition of methods is more and more resolved into a pure correlation. Psychology in this sense gives the

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approach to problems, which must seek their solution in logic and in their application to science. (Cassirer, 1923: 346).

Gestalt psychology was an attempt to re-discover the role played by psychology in the circle of knowledge. They referred to these laws mentioned in Chapter Five as structural orders to organize perceptual experience. In addition they were concerned with the phenomenological images that are constructively formed in respect of the process of transformation. The Gestalt theorists established a rational insight into the demands of how our perceptual judgement can be based on the phenomenological forms provided by a process of transformation. They were concerned with the structural connections between elements of the experience and the intrinsic bonds imposed by the total structure. Once this structure is seen, then the elements must follow one another in a certain way.

To sum up, the Gestaltists were consistent in their applications of both perception and learning. They emphasized that the same dynamical processes applied in perception are also applied to learning. They worked under a general theme that there is a constructive and systematic unity of the mind. They traced this unity and explained it in many different places. They shared with Cassirer the view that structural approach can set up a valid account of the objectivity of perception.

Conclusion

In the following reflections I shall attempt to set forth an inner connection-epistemological in nature- between the mathematical concept of group and certain fundamental problems of the psychology of perception as the latter have been more and more distinctly formulated in the last decades. To the end, we must look far afield. For the two scientific provinces which we are trying to connect appear at first sight to be entirely disparate as to their content. Yet, we should not allow ourselves to be misled by this disparity. What we are going to set forth concerns logic only, and not ontology. Our ultimate aim is to bring out clearly a certain type of concepts which has found its clearest expression in abstract creations of modern geometry. But the type in question is not confined to the geometrical domain. It is, on the contrary, of far more general validity and use.

(Cassirer,1944:5).

The main theme of this thesis was to find an answer of Cassirer's philosophical enterprise of how possible psychology can be developed in the light of logic not ontology? My answer was there is possibility to bring psychology to the circle of logic by finding out constant elements involved in perceptual experience. To trace these constant elements, we divided Cassirer's view of perception into three stages and we found out there is tremendous confirmation of the role played by these constant elements in perceptual experience. This thesis found that the terms used by Cassirer varied in respect to the philosophical problems he had discussed during these three stages of his theoretical development.

- 1- In Berlin stage (1900-1923), Cassirer had confirmed that the constant element which played role in the perceptual experience was *function* as an alternative element instead of *substance*. According to that view, the contents of a perceptual object are functionally related and organized within a structure instead of the view that

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considers contents of experience are simply added and aggregated from the external world.

- 2- In Hamburg stage (1923-1933), Cassirer used the *ideal meaning* involved in perceptual experience as a constant element which provides it with its unity. Cassirer claimed that the intuitional meaning, sometimes he referred to it as a symbolic meaning, is that constant element presupposed in perceptual experience.
- 3- In immigration stage (1933-1945), Cassirer used the concept of *group* as the constant element that organizes and orders the contents of perceptual experience.

In these three stages we could notice that Cassirer was consistent and coherent in his views and in his broad applications as seen in both exact and human sciences, where the attempt had made to understand what is changeable in respect to what is unchangeable or what is variable in the light of what is invariant.

These three constant elements pointed to one fact that Cassirer's aim was to set up a view that makes perceptual judgments are possible. To make these perceptual judgments possible, we reach to second conclusion that is Cassirer provided a transcendental answer of how an individual's judgment, regarding any single perceptual experience, can be possible? In other terms, how Cassirer understood the problem of the particular and the universal and how he understood the relationship between them. Being a Neo-Kantian, Cassirer suggested and proved that there are *schemata* inherent in perception. We indicated that perceptual judgments are possible if we organize our perceptual experience in the light of these constant elements. This apprehension led to important conclusion that an objective account of perception is possible when the contents of perceptual phenomena are related and organized in respect to these constant elements. Cassirer explained that the concept of group is considered one of these possible structural elements that can provide an objective understanding of perceptual phenomena which distinguishes it from dreams, hallucination and subjective judgments. To that extent, the Gestaltists shared with Cassirer the view that an objective theory of perception is possible when we organize the perceptual experience in the light of the structural elements presupposed by the dynamic functional activities of the mind.

Conclusion

We came to the conclusion that both Cassirer and the Gestaltists presupposed a constructive unity of the mind which led their analyses to bridge the different aspects of civilization and life claiming that there is a logical monism presupposed in every process of construction. We tried to trace these structural moments presupposed by the mind and which make the realms of civilization reasonable.

Finally, I tried to design a diagram demonstrating the way the phenomenological image is constructed as shown in the early pages of Chapter Five. My aim when I designed this diagram was to make the Gestaltists's account of perception easier and simpler than it was given by them. Moreover, I focused on these transformational processes in which an object represented by a retinal image can be converted to a constructed object represented by phenomenological image. I have showed the explanatory power of that diagram and how it could be used to illustrate the way our mind constructs the objects in the perceptual experience. Bringing this diagram out, could lead me to bridge Cassirer and the Gestaltists with the group theory. This diagram could provide an answer to more or less Kantian question of how can perception actually extract general objective features from singular contents of experience? I showed that these structural features can be developed when the individual's perspective is invariant under dynamic processes of transformation and rotation. Similar to geometrical space, geometrical properties are not substantial, but structural. In other words, there cannot be any ontological gap between geometrical objects and experienced spatial objects. The differences between them pertain to the way and the accuracy with which they are *determined*. By this diagram and its application we could give an answer to Cassirer's inquiry of how we bring perception to logic not to ontology.

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Glossary of Gestalt terms

Associationism: it refers to the attempt to explain complex wholes as concatenations of units, elements, or atoms combined together in a certain way. It also refers to the attempt to explain the mental phenomena in terms of the bonding elements. Associationism can be defined as an attempt to explain mental phenomena through relations among mental contents and representation-particularly relations such as contiguity and resemblance that cause them to become associated with one another.

Colour Transformation: that the colour of an object can be seen differently when some changes take place in the perceptual situation such as changing the intensity of light. These kind of changes lead to ascribe different colour to the same object.

Constitutional theory: represents the following position: all objects of cognition are constituted “in idealistic language generated in thought”; and moreover, the constituted objects are only objects of cognition through logical forms constructed in a determinate way. In the light of epistemological analysis, every science wants to reach its unity and completeness in the systematic construction of experience. The real meaning of object has to be comprehended under that scheme. Therefore, according to Cassirer, an object lies apart from that circle of understanding has to transcend that meaning and fits itself into that general account of construction.

Constructivism: is a dynamic process by which the mind constitutes its laws and applies them to what we experience either exact, social and cultural object, but there is no reason to suppose them applicable to things as entities.

Context: it refers to the totality of conditions that influence any individual in perceptual situation and affects that individual’s way of perceiving and interpreting the facts implied in that situation.

Creative Synthesis: it refers to a mental activity which produces outcomes that explained as “structures” or “constructive wholes” that are completely not an aggregation or summation of elements. Creative synthesis is that process contrasting the elementarism.

Glossary of some Gestalt terms as used in this thesis

Dynamic Process: It is a direct and a creative process of organizing and grouping the parts in a whole. The constituents of this dynamic process are invariance, transformations, relational effects, frames of reference, whole-part interactions, laws of grouping and a general tendency towards structuralism.

Fixed and absolute characteristics: refer to a metaphysical assumption that the objects we perceive have independent characteristics and hence remain unchanged apart from any changes might take place in perceptual situation.

Frame of reference: frame of reference is the quality of an organized whole upon it the elements of that whole will be reformed and reordered accordingly. Therefore the idea of frame of reference assumes there are functional relation among the units and the elements of the whole.

Functional- Relational Thought: it refers to an epistemological transition for speculation. It is an account that transcends the onto-metaphysical concerns regarding scientific objects and concepts. Ernst Cassirer calls this view is “*substantial thought*” while Max Wertheimer calls it “*traditional logic*” Instead it grasps a logical understanding of scientific objects where the object is considered a web of relations that occupies a relative place within a system or structure. The same view is also applied to scientific concepts where it discharges the concepts from their ontological constituents where there is no an absolute meaning, place, role and function of the concept. But the concept acquires its function and meaning from the structure that it occupies. Both Cassirer and Gestaltists hold that view through their literatures and their analysis to scientific concepts, such as; motion, acceleration and atom along with the major concept of perception.

Group Theory: it is an analogy to use the mathematical concept of group in the domain of perception. The point is to capture the relative properties of visually experienced objects with mathematical concepts in order to account for their constancy or determinability. It was an attempt to bridge between perception and

Glossary of some Gestalt terms as used in this thesis

geometry, although they are belonging two different domains of knowledge, on logical base.

Insight: insight means a meaningful behaviour and experience in the presence of any life situation. It is the suddenness of perceptual reconstruction of the field.

Invariant: is implying a constructive meaning that is in charge of re-organizes the spatial relations among the figure and reunifies them within new systems that enable us to perceive the same geometrical figure alternatively in respect to constructive meanings implied and presupposed in each perceptual system that remains unaltered in respect to the changes and replacements of spatial relations.

Objectivity of perception: objectivity of perception can be achieved when the contents of experience are based on those constant element involved in perceptual experience. These constant elements or "non physical element" are the only elements that make perceptual judgements possible. In virtue of these constant elements it distinguish perceptual experience from dreams and hallucination.

Perceptual or Phenomenological image: Cassirer used the perceptual image while the Gestaltists used the phenomenological image. These two images have the same epistemological meaning that is comprehended in contrast to retinal image. It does not depend on a rigid correspondence between local stimuli and experience but it depends on the total pattern of excitation of the sense organ concerned. Phenomenological image rejects the constancy hypothesis and set up on invariant hypothesis where the perceptual image maintains its properties and characteristics when the conditions of perceptual experience maintained unaltered and unchanged. The perceptual image involves always reference to a certain groups of transformation.

Perceptual Transformation: it refers to the fact that object, we perceive, has pure possibility to be transformed to another different perceptual form. This transformation is possible when we change our frame of reference in respect to it we perceive the object. For example, rectangle can be transformed and perceived as trapezium, in the case of perceptual space. In addition, grey can be perceived as black or white when

Glossary of some Gestalt terms as used in this thesis

we change the conditions of illumination. Or the black and white crosses, to perceive the colour of cross as black; we need to perceive it on white background and vice versa. This is a kind of transformation taking place in the case of colour perception.

Retinal image: is the view that interprets only the sensory impressions in perceptual experience, hence the task of any individual is to see objects as they are represented on the retina. This view claims that objects have independent properties even when the conditions of perceptual situation changes, one still perceive the same properties.

Sensory Atomism: is the view that considers excitation of the eye produces a mosaic of discrete and atomic visual experience.

Structuralism: The structuralism of the Gestalt completely differs from the structuralism of Edward Bradford Titchener (1867-1927) because the structuralism of the latter holds that psychological wholes are compounds of elements. Therefore psychology task is to discover the elements and the manner in which they compound. One must begin with the atoms or elements; science goes from the part to the whole. In other words, structuralism here is a synthesis of the complex or the whole out of the elements. On the contrary to that view, Gestalt structuralism depends on the whole and the possible re-arrangement of the elements in the light of the structure which is logically a prior and proceeds the elements.

Sometimes the term "structure" is used in a purely geometrical sense. But when I use the term in our present connection, it refers to a functional aspect of processes, to the distribution of such processes. A distribution which they assume (and may also maintain) as a consequence of the dynamic interrelations or interactions among their parts. (Kohler, W 1969,P91-92)

Structuralism of Perception: It refers to the quality of an organized whole over the particulars or parts implied within that whole. It is the logical relation between universal and particulars where the former logically proceeds the latter. Structuralism leads us to reach the unity of perception and its completeness in the systematic construction of experience. To set up a theory of perception on structuralism, we need first to be apart of using and explaining perceptual experience in the light of these terms such as summation, aggregation, addition, mechanism, mosaic, Associationism, Elmentalism and Atomism. Secondly, we need to create some orders through the

Glossary of some Gestalt terms as used in this thesis

dynamic activity of reason to arrange the parts and elements of perceptual experience in the light of these constructive orders to give perceptual experience its systematic unity. The characteristics of the structure determine the nature of the parts and of their interrelationships. Therefore, we define structuralism as “*pure possibility of re-arrangements under holistic wholes or orders*”

Transformation: it refers to the pure possibility of re-arrangement, re-organization, and re-orientation, which enables the individuals to view the given situation in a new and more penetrating perspective. It is this factor that leads to or constitutes a discovery in a deeper sense. In such cases a discovery does not merely mean that a result is reached which was not known before, that a question is somehow answered, but rather that a situation is grasped in a new deeper fashion-where the field broadens and larger possibilities come into sight. These changes of the situation as a whole imply changes in the structural meaning of elements or parts, changes in their place, their relations together, their role and function, which often lead to important consequences.

